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THESIS

DEFENSE INDUSTRY MERGERS AND MONOPOLY POWER: ANALYSIS OF ABNORMAL EARNINGS USING THE EDWARDS-BELL-OHLSON MODEL

by

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December, 1997

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Recent defense industry consolidation has created several large defense firms. As a result of merger activity with their suppliers and competitors, these firms account for an increasing percentage of sales to the Department of Defense. This thesis investigated seven large defense industry mergers, involving 12 defense firms, to assess the effect of the mergers on the firms. Changes in a firms' anticipated abnormal earnings both premerger and post-merger were analyzed to determine whether the defense firms exhibit monopoly power. The merger process was divided into five stages. The Edwards-Bell-Ohlson (EBO) valuation model was used to create measures of firms' expected abnormal earnings at each stage. Each firm's resulting abnormal rates of return on equity were observed and analyzed between stages to track changes in assessments of expected abnormal earnings as the merger process proceeded. Major findings indicate that post-merger abnormal rates of return increased from premerger levels for all firms. These findings are consistent with defense firm earnings power and monopoly position increasing due to merger activity.

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requirements for the degree of

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December 1997

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Recent defense industry consolidation has created several large defense firms. As a result of merger activity with their suppliers and competitors, these firms account for an increasing percentage of sales to the Department of Defense. This thesis investigated seven large defense industry mergers, involving 12 defense firms, to assess the effect of the mergers on the firms. Changes in a firms' anticipated abnormal earnings both premerger and post-merger were analyzed to determine whether the defense firms exhibit monopoly power.

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TABLE OF CONTENTS

I. INTRODUCTION **1**

A. BACKGROUND 1
B. OBJECTIVES AND RESEARCH QUESTIONS 2
1. Primary Research Question *3*
2. Secondary Research Questions *3*
C. METHODOLOGY 3
1. Literature Review *3*
2. Data Collection *4*
3. Data Analysis *5*
D. SCOPE, LIMITATIONS AND ASSUMPTIONS 5
E. ORGANIZATION OF STUDY 6

II. BACKGROUND AND LITERATURE REVIEW **9**

A. OVERVIEW 9
B. BACKGROUND 9
1. History and Events *9*
2. DOD Role in Mergers *14*
C. LITERATURE REVIEW 16
1. Merger Theory *16*
2. Current Issues Related to Defense Industry Mergers *19*
3. Monopoly Theory *23*
D. SUMMARY 27

III. EDWARDS-BELL-OHLSON (EBO) MODEL **29**

A. OVERVIEW 29
B. ORIGINAL MODEL 30
C. MODEL TRANSFORMED 34
1. The Security Market is Efficient *35*
2. Annual Return on Equity is Constant *35*
3. Book Value Grows at a Constant Rate *36*
4. Monopoly Power Implies the Ability to Earn Abnormal Earnings Indefinitely *37*
D. SUMMARY 39

IV. METHODOLOGY **41**

A. OVERVIEW 41
B. SAMPLE FIRMS AND MERGER EVENTS 41
1. Sample Identification *41*
2. Time Period Covered by the Merger Sample *43*
C. STRUCTURE OF THE ANALYSIS 44
1. Premerger Period *45*
2. The Announcement Date *46*
3. Interim Period *46*
4. Post-Merger Period 1 ..... *47*
5. Post-Merger Period 2 ..... *48*
D. DATA COLLECTION 49
1. Stock Prices *49*
2. Cost of Capital Data *50*
3. Book Value *51*

4. Dividend Payout Ratio *52*
E. NORMALIZING EBO MODEL INPUTS 53
1. Price *53*
2. Cost of Capital *54*
3. Book value *58*
4. Growth Rate/Dividend Payout *61*
F. SUMMARY 62

V. DATA PRESENTATION AND ANALYSIS 63

A. OVERVIEW 63
B. DATA PRESENTATION 63
1. Northrop Acquires Grumman *65*
2. Lockheed Corp. Merges with Martin Marietta *68*
3. Raytheon Acquires E-Systems *71*
4. Lockheed Martin Acquires Loral *74*
5. Boeing Merges with McDonnell Douglas *77*
6. Raytheon Pending Merger with Hughes Defense *80*
7. Lockheed Martin's Pending Merger with Northrop Grumman *84*
C. DATA ANALYSIS 87
1. Premerger to Announcement *90*
2. Announcement to Consummation *92*
3. Premerger to Consummation *94*
4. Interim Period to Post-Merger Period 1 ..... *96*
5. Post-Merger Period 1 to Post-Merger Period 2 ..... *98*
6. Direct Comparison of AROE Values *100*
D. OBSERVATIONS CONCERNING THE EBO METHODOLOGY 102
E. SUMMARY 103

VI. CONCLUSIONS AND RECOMMENDATIONS 105

A. SUMMARY 105
B. CRITIQUE OF EBO METHODOLOGY 105
C. CONCLUSIONS 107
D. RECOMMENDATIONS FOR FUTURE RESEARCH 109

APPENDIX A. DEFENSE INDUSTRY CONSOLIDATION TIMELINE 111

APPENDIX B. DATA TABLES 113

LIST OF REFERENCES 127

INITIAL DISTRIBUTION LIST 131

I. INTRODUCTION

A. BACKGROUND

The Department of Defense (DOD) procurement budget has decreased nearly 65% in real terms since its 1985 high. This sharp decline in spending has caused an increase in defense industry mergers and restructuring by individual firms. The Defense Science Board Task Force on Vertical Integration identified 34 defense mergers and acquisitions that were consummated from 1994 through March 1997 (DSB, 1997). The consolidation of the defense industrial base raises issues for DOD concerning competitiveness, vertical integration, and maintaining industrial capabilities needed to meet current and future national security requirements.

DOD relies on market forces to the maximum extent possible to guide the development and sustainment of industrial capabilities. Recent defense industry consolidation has created several large defense firms. These large defense firms account for an increasing percentage of sales to DOD as a result of merger activity with their suppliers and competitors. The wave of mergers between the largest defense firms in 1996 and 1997 raises concerns for a monopoly emerging.

Even though the Federal Trade Commission has approved all merger proposals for these firms, the possibility for

monopoly power (higher prices for goods and services for DOD) to exist after the merger is omnipresent. Firms exhibit monopoly power by their ability to earn higher than normal return on their invested capital, termed abnormal earnings.

B. OBJECTIVES AND RESEARCH QUESTIONS

The objective of this research is to investigate and analyze anticipated abnormal earnings of defense firms in the wake of the furious merger activity within the industry. The research starts with the premise that a firm's future earning power is reflected in the current value of its stock, since investor expectation of future earnings are discounted into the stock price. The research employs the Edwards-Bell-Ohlson (EBO) accounting valuation model to identify abnormal earnings of defense firms pre and post-merger. The EBO model provides a method, using accounting data, stock prices and cost of capital to measure expected abnormal earnings. Analyzing differences in abnormal earnings of pre and post- merger firms leads to conclusions about monopoly power.

There have been numerous studies of industry concentration effects on competition. This research is the first of its kind that attempts to quantify the anticipated gains in profitability of dominant firms in the defense industry as a result of recent mergers. Ultimately, the

research examines whether merger activity in the defense industry has created monopoly power in selected defense firms. The research attempts to answer the following primary and secondary questions:

1. Primary Research Question

Has merger activity in the defense industry increased monopoly power of individual defense firms?

2. Secondary Research Questions

1. What is the relationship between monopoly position, earnings power, and the ability to generate abnormal earnings?
2. What is the EBO model and how can the EBO model be used to quantify a firm's ability to earn abnormal returns?
    a) What is a firm's level of abnormal earnings before a major acquisition or merger?
    b) What happens to a firm's level of abnormal earnings after announcing a merger to the market?
    c) What is the merged firm's level of abnormal earnings?
3. How does a firm's abnormal earnings change as a result of a merger?

C. METHODOLOGY

Research was conducted in three distinct phases: literature review, data collection and spreadsheet building, and data analysis. Each phase is summarized below.

1. Literature Review

A thorough investigation of the literature relating to defense merger activity was conducted using the Lexus/Nexus data base, Internet, periodicals, Government Accounting Office (GAO) reports, and DOD publications. In addition,

academic literature relating to merger and monopoly theory and the EBO model provided the framework for the analysis. A major portion of this research involved transforming the original EBO model. The literature review resulted in material found in Chapters II and III.

2. Data Collection

This phase included the tasks of identifying data sources, selecting a sample population of defense firms, collecting data for EBO model input, and calculating abnormal earnings for each firm through several stages of their merger process.

Twelve large defense firms involved in seven mergers since 1994 were selected from the aerospace and defense industry group for use in the study. Firms were among the top 20 U.S. defense firms in the year analyzed and derived at least 25 percent of their revenue from the defense department.

Data collection efforts focused on firm accounting data as well as market data required for use in the EBO model. Annual and quarterly financial statements for existing defense firms provided accounting data. Other investment reference publications contributed data for firms no longer in existence. Non-accounting data, including risk premiums and stock prices, was collected from various electronic and hard copy sources.

The merger process was divided into five distinct stages so that discrete measures of abnormal earnings could be analyzed. The stages are: Pre-Merger Period, Announcement Date, Interim Period, Post-Merger period 1, and Post-Merger period 2. The data was normalized for all firms over these stages to calculate abnormal earnings assessed at each stage. Chapter IV introduces the merger timeline used for structuring the analysis.

3. Data Analysis

Calculations using the EBO model resulted in measures of the rate of expected future Abnormal Return on Equity (AROE) assessed at the various stages in the merger process. Observations of AROE for each firm were compared between stages. The changes in a firm's AROE was analyzed to assess the effects mergers had on a firm's ability to generate abnormal earnings.

D. SCOPE, LIMITATIONS AND ASSUMPTIONS

This research evaluates abnormal earnings of selected defense firms, both pre and post-merger, to assess the presence of monopoly power in those firms. Specifically, the research attempts to isolate abnormal earnings in defense firms during and after the merger process using a transformed version of the EBO model. The model employs stock price, cost of equity capital, book value and dividend

payout ratio to render an anticipated abnormal rate of return on equity. This study is a firm by firm analysis and is not concerned with the overall trends of monopoly verses competition in the economy. Furthermore, no attempt is made to measure or assess the current health of the defense industry due to merger activity. The research focuses instead on identifying the implications of mergers involving defense firms for the firms ability to exercise monopoly power and generate abnormal earnings.

Assumptions relating to the EBO model are explained in detail in Chapter III.

E. ORGANIZATION OF STUDY

Chapter II discusses defense merger background and the literature related to merger and monopoly theory. The background section discusses history and events in defense mergers and lays the foundation for why DOD is concerned with defense mergers.

Chapter III introduces and develops a form of the EBO model for use in the research to measure abnormal earnings. Chapter IV is a discussion of the research methodology including, sample selection, structure of the analysis, data collection techniques, and use of variables employed in the EBO model.

Chapter V describes the firms and mergers in the sample and presents the resulting measures of abnormal rates of return from the transformed EBO model. Data is analyzed to assess the impact of merger activity on abnormal earnings. Chapter VI summarizes conclusions from the research and provides recommendations for further study.

II. BACKGROUND AND LITERATURE REVIEW

A. OVERVIEW

This chapter highlights the reasons and logic for exploring the subject of monopoly power in defense firms. It is broken into two sections; Background and Literature review. The background section discusses the history and events in the defense merger game, and DOD's concern with mergers in general. The latter section investigates the literature relating to merger and monopoly theory. Defense industry specific merger issues are also discussed.

B. BACKGROUND

1. History and Events

In the 1990's, the primary reason for defense industry merger activity is DOD's decreasing demand for goods and services reflected in a shrinking procurement budget. Merger activity began increasing in the mid 1980's as the authorized defense procurement budget peaked. In today's declining budget environment, some firms seek to exit the business while others seize the opportunity to increase their market share. It is interesting to note that while defense procurement authorization peaked in 1985 at $96 billion (1996 dollars), actual outlays did not peak until

1991 at $82 billion (Modzelewski, 1996). Figure 1 illustrates this trend.

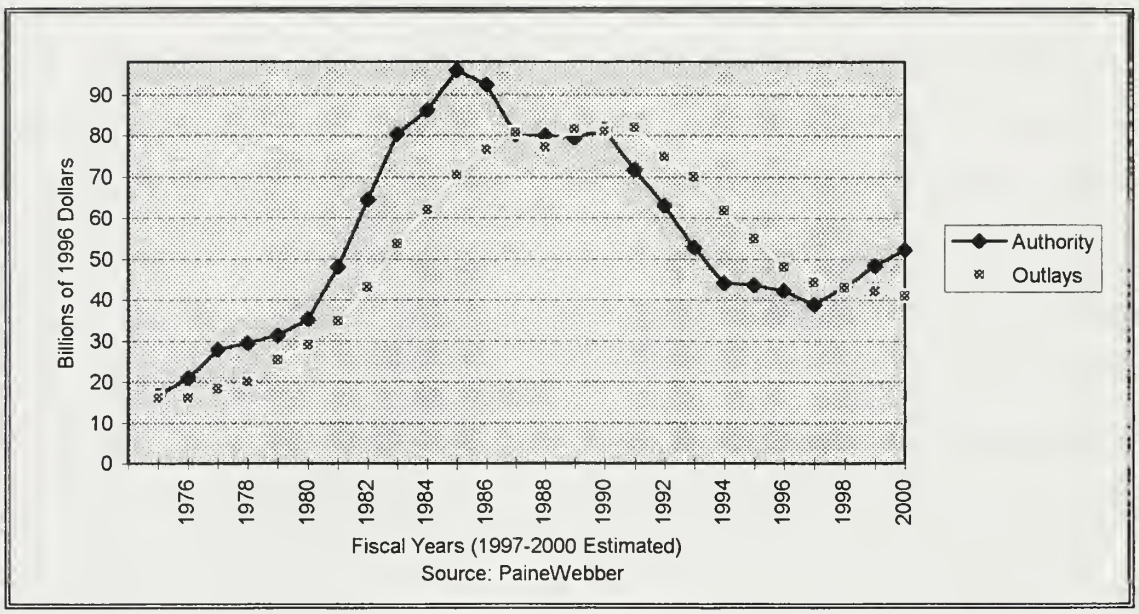


Figure 1. Procurement Authority vs. Outlays

Since 1991, procurement outlays have been in decline. The downturn in spending is forecast to bottom out in fiscal year 2000 at $41 billion. Proposed increases in procurement spending authority in future budgets will not show up for another three to five years. Defense firms are simply positioning themselves for the worst.

In economic terms, defense firms are seeking to lower their long run average costs by cutting overhead, reducing capacity and taking advantage of efficiencies offered by technology. Firms that derive most of their sales from

defense goods and services are focusing on those core competencies, while firms with declining market share are shedding defense business units. The Defense Science Board Task Force on Vertical Integration and Supplier Decisions (1997) summed it up best in this statement:

> Defense firms are seeking to increase revenue by buying other firms' existing or "backlog" orders, to improve profit margins and stock market performance, and to reduce excess capacity. They are also diversifying their product lines to increase opportunities for future sales. They may act to "buy now" if attractive or important businesses become available, in part to deny them to competitors. Finally, many defense firms are buying electronics and software integration capabilities. While electronics and software capabilities may be particularly judged as vertical additions, firms may see these as a key to future system integrator capabilities, or simply as the potential growth market in defense. (p. 9)

Several defense firms have been on a buying spree in the last three years. For example, Litton Industries purchased six niche electronics companies since 1994 to increase its competitive position. Table 1 lists significant merger activity from March 1994 to July 1997.

Table 1. Notable Defense Mergers March 1994-July 1997

Acquiror	Acquiree	Value	Date
Loral	IBM Federal Systems	$1.575B	3/1/94
Northrop	Grumman	$2.100B	4/4/94
Martin Marietta	General Dynamics Space Systems	$209M	5/2/94
Westinghouse Elec Sys	Norden Systems	<$100M	6/1/94
Northrop Grumman	Vought	$130M	7/31/94
Allied Signal	Textron Lycoming	~$375M	10/28/94
Litton	Teledyne Electronic Systems	not avail.	12/30/94
Hughes	CAE Link	$170M	2/27/95
Alliant Techsystems	Hercules Aerospace	$466M	3/15/95
Lockheed*	Martin Marietta	>$9B	3/15/95
Rolls Royce	Allison Gas Turbine	$525M	3/30/95
Tracor	Lundy Tech Center	$7M	3/31/95
Loral	Unisys Defense Operations	$862M	5/5/95
Litton	Imo	not avail.	6/5/95
E-Systems*	Raytheon	$2.3B	6/15/95
General Dynamics	Bath Iron Works	$300M	9/17/95
GM Hughes	Magnavox Electronic Systems	$370M	12/14/95
Litton	Hughes-Delco Inertial Systems	~$70M	12/31/95
Allied Signal	Northrop Grumman Precision	~$50M	12/31/95
Logicon	Geodynamics	$32M	1/19/96
Litton	Sperry Marine	$160M	2/9/96
GM Hughes	Litton-Itek	$26M	2/16/96
Litton	PRC	$425M	2/20/96
Northrop Grumman	Westinghouse Electronic Systems	$3.6B	3/2/96
General Dynamics	Teledyne Vehicle Systems	$55M	3/29/96
Lockheed Martin	Loral	$9.5B	4/22/96
Raytheon	Chrysler Technologies	$455M	6/14/96
Southwest Marine	Continental Maritime	not avail.	6/14/96
GEC-Marconi	Hazeltine	$110M	7/10/96
Tracor	Cordant	$65-80M	9/26/96
Boeing	Rockwell Aerospace & Defense	$3.025B	12/6/96
Litton	SAIT Division of SAIC	not avail.	12/31/96
General Dynamics	Lockheed Martin Armament & Defense Systems	$450M	1/1/97

GM Hughes	Alliant Techsystems Marine Systems Group	$141M	2/28/97
Boeing*	McDonnell Douglas	$13.3B	8/4/97
	Announced/Under Review		
Raytheon	Texas Instruments Defense Business	$2.95B	7/11/97
GM Hughes Defense Business	Raytheon	$9.5B	NA
Lookheed Martin	Northrop Grumman	$11.6B	NA

*For mergers, acquiring and acquired companies are shown in alphabetical order.

After: Defense Science Board Task Force on Vertical Integration and Supplier Decisions (1997)

As merger activity increases, larger and larger firms are being created. In 1995, Boeing and McDonnell Douglas were in talks to merge (Sterngold, 1995). At the time, both parties thought the FTC would not tolerate the deal and discussions broke off. Since then, Raytheon has announced plans to merge with Hughes' Defense Business ($9.5 billion) and has acquired Texas Instruments Defense Systems and Electronics group ($2.95 billion) (Orwall, Lipin, & Wilke, 1997). Lockheed gobbled up Martin Marietta and Loral Corporation increasing its revenue base to $25 billion in 1996. In December 1996, Boeing and McDonnell Douglas announced plans to merge. The Federal Trade Commission and European Union gave final approval for the merger in July 1997 which will create a $48 billion revenue firm with 223,000 employees ("Boeing Completes," 1997). On July 3,

1997, Lockheed announced plans to buy Northrop Grumman Corporation for $11.6 billion. These events have consolidated the industry down to three powerhouse aerospace defense firms. One industry analyst commented, "We're getting to the time in the cycle where there are very few contractors, especially at the prime contractor level...they have a significant amount of control over the process" (Liu, 1997). Appendix I shows a comprehensive timeline of defense firm merger history since 1980. As a result of these events, DOD has taken an active interest in defense industry consolidation.

2. DOD Role in Mergers

When defense firms propose a merger, several processes begin. The firm must submit a Hart-Scott-Rodino filing with the Federal Trade Commission (FTC) and the Antitrust Division of the Department of Justice (DOJ). These agencies have 30 days to review the filing and determine if they wish to investigate further. The agency expressing interest will conduct the formal review or if both have interest one or the other will take the lead. The lead agency will then consult with DOD.

The DOD conducts its review from a customer perspective focusing on understanding how the proposed transaction might affect cost, competition, innovation and industrial capabilities in current and future programs. This review is

led by the Under Secretary of Defense for Acquisition & Technology USD(A&T) in accordance with DOD Directive 5000.62.

The Deputy Under Secretary of Defense for Industrial Affairs & Installations develops recommendations, proposals, and analysis that provide the economic and business rational for the final DOD decisions and policies on mergers and acquisitions in the defense industry. The military departments and defense agencies also review the proposals to identify areas where the firms are currently competing, may compete in the future and areas that pose vertical integration issues (DSB, 1997).

It is important to understand that DOD does not have the final say in the decision to allow or disallow a merger. The FTC or DOJ have authority to approve mergers, but DOD's feedback often results in clauses in the consent agreement. DOD's policy on mergers has been to review their impact on the industrial base while the FTC and DOJ evaluate them from an antitrust standpoint.

Consolidation and restructuring as cost cutting measures may cause some firms to lose the capability to produce certain products for DOD. When defense firms report that they may no longer provide a product or service, or are leaving that line of business completely, DOD must assess the impacts of such a course of action. DOD may maintain a

certain level of production for the firm to stay in business and ensure a source of the product in the future whether it meets DOD's short term requirements or not. In these instances, an objective analysis for the needed capability is conducted with guidance from DOD Directive 5000.60, Defense Industrial Capabilities Assessments (OUSD, A&T, 1996).

DOD only considers preserving a capability that is needed to support national security. Any program manager or service may initiate an Industrial Capabilities Analysis if the product or service they buy will become unavailable or is at risk of becoming unavailable during the life cycle of the program. The latter situation most likely occurs when firms merge and restructure.

C. LITERATURE REVIEW

Two subsets of literature are relevant to this research. The first explains why firms merge and the difficulty in assessing their effects on markets. It also discusses three issues facing defense industry firms today. The second subset deals with the economists' perspective on monopoly and defines abnormal earnings.

1. Merger Theory

Mergers combine two or more firms into one. The underlying motive for merger activity is to gain profits (Ravenscraft, Scherer, 1987). William G Shepherd (1997)

breaks down three main reasons for mergers, "market power, technical economies, and pecuniary economies" (p. 151). Economies of scale and vertical economies are forms of technical economies that can be achieved through merger activity. However, compared to internal growth and long term contracts, "...the net technical gain from mergers is usually small, zero, or even negative" (Shepherd, 1997, p.16). Mergers yield pecuniary economies (money benefits without improving the use of resources) through lower input prices, tax and/or accounting rules, and promotional advantages. Firms seek market power to achieve higher profitability. Market power in defense firms is usually influenced by the type of merger, either horizontal or vertical.

a. Horizontal Mergers

Horizontal mergers raise market power by eliminating competition between two firms. The Boeing, McDonnell Douglas merger exemplifies the horizontal merger since both companies produce large commercial passenger aircraft. The economic detriment to customers from horizontal mergers depends on the market share of the firms and the concentration ratio of the industry. The structure of the defense industry has historically been very concentrated (Ciccotello, 1997). Research done by Joe Bain and George Stigler in the 1950's suggested that industries

with high four-firm concentrations were anti-competitive. However, economists Yale Brozen and Harold Demsetz identified situations where increased profits were due to "superior efficiency" rather than anti-competitive conduct. (McChesney, 1993)

Antitrust agencies use the Herfindahl-Hirchmann Index (HHI) to measure horizontal concentration in a market (DSB, 1997). Economist Oliver Williamson showed that, "...even a merger that caused a large increase in monopoly power would be efficient if it produced only slight cost reduction" (McChesney, 1993 p.387). Therefore, high industry concentration ratios are considered less important as an indicator of monopoly power in today's antitrust cases. This partly explains why the FTC approved Boeing's merger with McDonnell Douglas in July 1997 allowing the new company to command 70 percent of the commercial airline manufacturing business (Fox, 1997).

b. Vertical Mergers

Vertical mergers add supplier product lines to the firms existing production chain. The General Dynamics acquisition of Teledyne Vehicle Systems combat vehicle components business in 1996 provides and example of a vertical merger. There is no clear evidence that vertical mergers increase market power (Shepherd, 1997). A more difficult task is to actually determine the market effects

of vertical integration. The following excerpt from the DSB (1997) highlights the problem.

> The Task Force cannot assign a specific value or measure to this increased vertical integration, as it did not find a way to specifically measure its degree or scale, or to narrow it to a certain product area. Neither the industry analysts, antitrust agency representatives, nor members of the industry who spoke to the Task Force said that they measure industry vertical integration, nor did they propose a mechanism to do so (D-3).

To expand on merger theory, the following section discusses three issues relevant to defense firms' recent merger activity.

2. Current Issues Related to Defense Industry Mergers

There are many reasons for merger activity in the defense industry. This section highlights three of those issues: 1) Market performance of defense firm stock prices, 2) DOD's policy toward paying merger costs, and 3) Competition.

a. Defense firm stock market performance

The defense industry has historically expanded and contracted with defense spending cycles. The difference in today's environment from past declines in spending after World War II and Vietnam is that the industry sees this draw down as permanent. With the Cold War over and no clear strategic threats on the horizon, defense spending has no reason to rise significantly. Nevertheless since 1990, Wall Street has rewarded the defense industry with increasing

stock prices. Paine Webber's weighted average defense stock index (including Boeing) has outperformed the Standard and Poor's 500 index handily in the last six years (Modzelewski, 1996). This notion is counterintuitive given that defense spending was declining during this period. More puzzling still is that defense stocks under performed the market during the Reagan buildup of the 1980's. Figure 2 graphically shows how an index of defense firms outperformed the benchmark S&P 500.

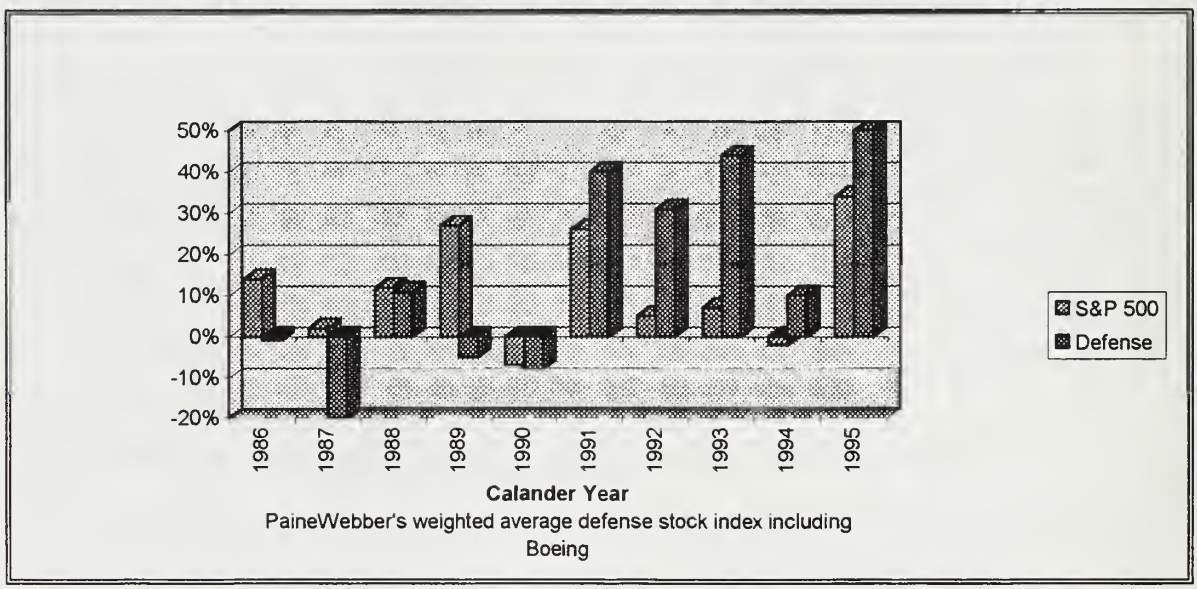


Figure 2. Defense Industry Stock Performance

This surge in stock performance in the defense industry directly coincides with an increased occurrence of mergers in the last six years. Investors see value in firms

that consolidate, trim excess capacity and increase efficiency.

b. DOD's Merger Reimbursement Policy

The second issue that some industry analysts believe contributes to merger activity in defense firms is DOD's policy to reimburse firms for merger costs. In July 1993, DOD allowed defense contractors to charge restructuring costs to transferred flexibly priced contracts after a merger. These costs could be charged only if they were allowable under the Federal Acquisition Regulation (FAR) and if a contracting officer determined that the merger lowered overall costs to DOD (GAO, 1997b). DOD in effect pays for some merger costs that are imbedded in the price of goods and services it buys. These costs, "...come in the form of future adjustments to allowable costs for weapons systems" (Fialka, 1996, p.A17).

Reimbursements only occur after the merger is consummated and after the firm's projected restructuring savings are certified by the Under Secretary of Defense for Acquisition & Technology (USD,A&T). The five mergers approved by DOD for reimbursements have spent $849 million for restructuring activities. As of September 30, 1996, the Defense Contract Audit Agency (DCCA) estimated that DOD reimbursed about $179 million to contractors for restructuring costs, but realized savings of $347 million

since July 1993 (GAO, 1997b). Preserving competition in the defense industry is the third and final issue.

c. Competition

From an economic standpoint, competition should drive down costs and create incentive for innovation. The acquiring firm's goal in most merger decisions is to enhance or preserve their competitive position in their market. In an environment of declining defense spending, defense firms claim that they need to be big to afford to win contracts and have enough money left for research and development (R&D) (Cole, 1996). Some pundits argue that having only a few huge contractors will weaken DOD's negotiating power and lead to higher prices (Egan, 1996). While DOD's position supports consolidation, its 1996 annual report recognized, "Consolidation carries the risk that DOD will no longer benefit from the competition that encourages defense suppliers to reduce costs, improve quality, and stimulate innovation" (GAO, 1997a, p.21).

There exists differing views on the need for competition, even among federal agencies. Concerning the industry trend toward consolidation, Cole (1996) quoted the FTC Chairman:

> It's very hard to work out a cartel where you're talking about weapons systems that are different from each other in a bid market in which there's only one buyer, and that buyer has the right by law to check your books, require re-bids, and do cost-benefit analysis (p. A1).

A Defense Science Board 1994 report on consolidation challenges this view. The report concludes that competition is preferred over DOD's regulatory and auditing procedures to ensure the best mix of price and quantity (GAO, 1997a). Norman Augustine, Chairman of Lockheed Martin, has endorsed industry consolidation to achieve efficiencies since the early 1990's. He believes that consolidation is healthy, and states, "It's better to have two strong companies than ten inefficient ones" (Egan, 1996, p.51). In its 1994 report to DOD on the antitrust issues of defense industry consolidation, the Defense Science Board stated, "... reducing the number of firms capable of developing a suitable design for a new weapon system may lead to higher prices, poorer products, smaller advances in technology, and a reduction in the number, variety, or quality of the proposals that companies submit to DOD" (GAO, 1997a, p.22).

3. Monopoly Theory

This section reviews literature relevant to monopoly theory and introduces the key concept of abnormal earnings which is the basis for the empirical research conducted later in this thesis. George J. Stigler (1993) defines monopoly as, "an enterprise that is the only seller of a good or service" (p. 399). The monopolist sets a price that yields the largest profit and freely does so in the absence

of competition. Pure monopoly has just one firm that is protected by high barriers to entry and inelastic demand. Familiar examples of monopolies are electric, water, and cable television companies that exist with the help of government regulations. Pure competition exists on the opposite pole from monopoly.

Effective competition requires strong mutual pressure among firms and relative equality of size and market share. Structurally, many firms must exist so that they can not collude in price setting. There should be a minimum of five comparable firms in a market for effective competition (Shepherd, 1997). A high number of firms ensures that no one firm is dominant and new competitors may easily enter the market. Industry structure varies considerably between these two extremes in any given market.

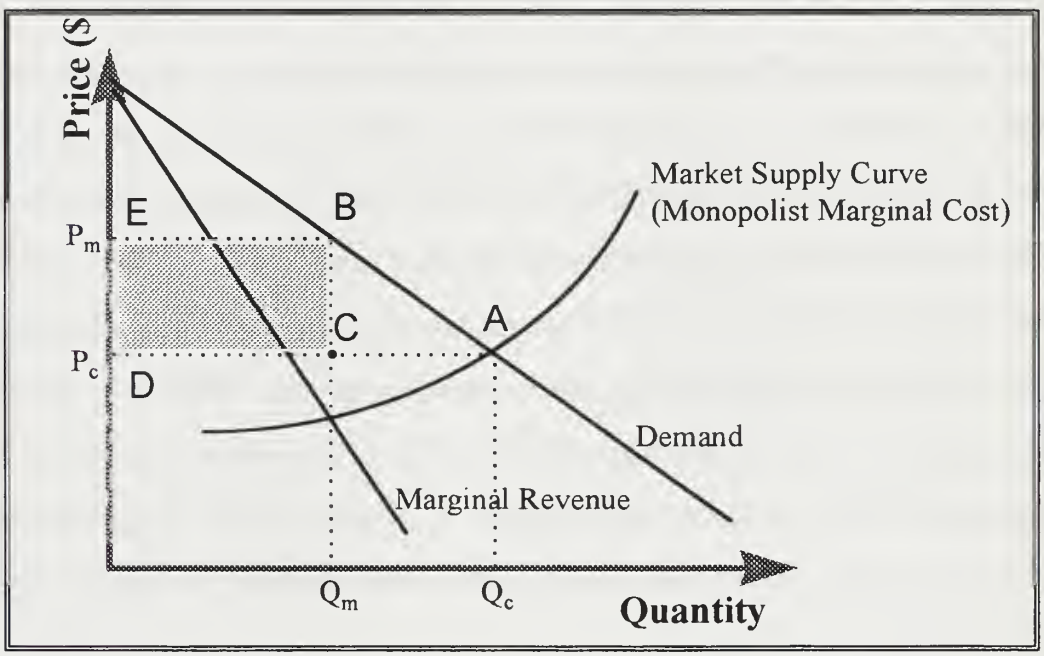
Monopoly power allows firms to set prices higher than in competitive markets yielding profits in excess of all costs, including their cost of capital. Economic theory concludes that industries with high seller concentration - monopolies - "are likely to charge higher prices and earn higher profits than industries with low concentration" (Caves, 1992 ,p.14). Most of the economic literature refers to monopoly profits as economic rent, pure profit, or excess profit. Since competitive firms earn only a normal profit, earnings to cover all costs including the cost of capital,

abnormal earnings are the earnings a firm reaps in excess of a normal return on capital.

Competitive firms may earn a small degree of abnormal earnings in the short run, but easy entry into a given market allows competitors to lower prices and return these profits to zero. Monopolistic firms effectively continue collecting abnormal earnings as long as entry into a market remains difficult. The defense industry requirement for capital intensive, specialized production equipment, access to scientific and engineering talent, and the high costs of preparing contract proposals all decrease the likelihood that new firms will enter the market (GAO, 1997a). Monopoly contributes to many negative societal effects, but this research only tries to measure the level of abnormal earnings defense firms are collecting that may be due to mergers.

The source of abnormal earnings for a monopoly is illustrated in Figure 3. The intersection of the supply and demand curves, Point A, yields competitive firms normal profit through market price and quantity, P_c and Q_c. Based on where its marginal revenue equals marginal cost, Point B on the demand curve, the monopolist sets price and output, P_m and Q_m. Since the price has been raised to customers, the rectangle EBCD represents the increased dollar payments

consumers pay. The monopoly retains these dollars as their abnormal earnings. There is also a welfare loss to society represented by triangle BAC that results from resource misallocation caused by monopoly power (Shepherd, 1997).



After: Shepherd (1997, pp. 45,46)

Figure 3. Monopoly Pricing

Beyond the potential for paying higher prices for goods and services, there is one additional effect of monopoly power with critical importance to DOD. There exists two diverging opinions on monopoly power's effect on Research and Development (R&D). William Shepherd describes the negative effects from monopoly in this passage:

> A monopoly is under less pressure to invent new products or methods, and so the generation of new ideas becomes voluntary. The pressures are also less to translate new ideas into practical innovations. In fact, the pace of innovation will be retarded, because innovations destroy the value of the monopolist's existing products and processes. By altering the incentive structure, monopoly discourages innovation (p. 46).

In contrast, Levy (1993) cites Joseph Schumpeter's argument that since a monopoly reaps all the benefit from R&D, it will have an incentive to invest more heavily in R&D than a firm in a competitive industry. Competitive firms have little incentive to engage in R&D since discoveries would be quickly imitated by other firms. A competitive firm would only receive a small share of the benefits from its R&D expenses. "The monopolist shares the benefits of his R&D with no other firm and will use a portion of its excess profits to invest in R&D" (Douglas, 1982 p.225).

Using Schumpeter's theory, DOD would prefer monopolistic firms who invest their own capital in R&D over a highly competitive market. However, the pricing power afforded to the monopolist is detrimental to DOD's attempt to keep weapon systems costs low.

D. SUMMARY

Shrinking defense procurement budgets have caused the defense industry to consolidate as firms seek to increase their market share. The profit motive has culminated in a

highly concentrated defense industry ruled by three aerospace behemoths; Boeing, Lockheed Martin, and Raytheon.

DOD reviews all mergers from a customer perspective while FTC and DOJ reviews evaluate mergers from an anti-trust standpoint. Research by Bain and Stigler suggested that industries with four-firm concentrations were anti-competitive. Conversely, Brozen and Demetz found circumstances where increased profits by concentrated industries were due to superior efficiency. Industry concentration ratios and measures of vertical integration are not effective in assessing monopoly power.

Economic theory suggests that monopolies earn abnormal earnings through power to set prices above those offered in a competitive market. If the defense industry displays such power, it would have negative effects on DOD's ability to receive the best value for its defense dollar.

In Chapter III, the research turns to the stock market valuation and accounting data of defense firms to measure expected abnormal earnings. The Edwards-Bell-Ohlson (EBO) model is introduced as the procedural tool to measure abnormal earnings.

III. EDWARDS-BELL-OHLSON (EBO) MODEL

A. OVERVIEW

The intent of this thesis is to analyze merger activity in the defense industry in terms of its impact on the market or monopoly power of the defense industry firms engaged in the mergers. A central premise is that market power will manifest itself in the ability to produce abnormal earnings. Thus, the impact of a merger can be assessed by observing changes in anticipated abnormal earnings resulting from the merger. This chapter introduces the EBO model, which will be used as the framework for determining abnormal earnings.

The chapter first introduces the EBO model as it exists in the literature, as a model for determining the intrinsic value of a firm, and hence stock value. The model is then transformed to a form that can be used to determine measures of expected abnormal earnings.

The original Edwards-Bell-Ohlson (EBO) model was developed by Columbia University professor James Ohlson to analyze a firm's market value as it relates to future earnings, book values and dividends (Ohlson, 1995). The model employs abnormal (sometimes referred to as residual earnings or income) earnings as a variable that influences firm value. Professor Ohlson provides this description of the EBO model:

> This accounting based performance measure is defined by earnings minus a charge for the use of capital as measured by beginning-of-period book value multiplied by the cost of capital (Ohlson, 1995, p.662).

Professor Lee of the University of Michigan successfully applies the EBO model to estimate value per share of publicly traded firms (Wooley, 1997). His analysis has discovered over and undervalued stocks in relation to current stock price using the model.

B. ORIGINAL MODEL

The EBO model is mathematically identical to the present value of future dividend models (DDM) and equivalent to the present value of Discounted Cash Flow model (DCF) (Lee, 1996). The EBO model measures wealth creation through reinvested earnings verses wealth distribution through payment of dividends. EBO's focus on only residual income and not the entire future cash flow gives it a primary advantage over using a DCF model. This property was the critical criterion in choosing the model for this research.

The EBO model in simplest form is shown as the equation below:

Firm Value at time t = Book value of equity at time t +
Present value of all future abnormal earnings

This conceptualization of firm value rests on three assumptions adopted by Ohlson (1995):

- The present value of expected dividends determines market value.

- Dividends reduce book value without affecting current earnings.
- Abnormal earnings are current earnings minus a charge for the use of capital.

The most general representation of the model is shown in Equation 1:

$$P_0 = B_0 + \frac{E_1 - (r_e x B_0)}{(1+r_e)} + \frac{E_2 - (r_e x B_1)}{(1+r_e)^2} + \frac{E_3 - (r_e x B_2)}{(1+r_e)^3} + \ldots \qquad (1)$$

Where:

P_t = Firm value at time t

E_t = Earnings at time t

B_t = Book value at time t

r_e = Cost of Equity Capital

Book value is based on accounting numbers from financial statements, and assumes the clean surplus relation that says, "a firm's book value should be changed only by dividends and earnings" (Lee, 1996 p.33). Thus, Book value at time t = $B_t = B_{t-1} + E_t - D_t$, where, D_t = Dividends at time t.

A firm generates abnormal earnings when it earns a higher than "normal" rate of return on its equity. A normal rate of return is a return equal to the cost of equity

capital (r_e). Thus, abnormal earnings in any period is represented by:

Abnormal Earnings = Earnings - (Cost of equity capital x Beginning book value)

or:

Abnormal Earnings = E_t - (r_e x B_{t-1})

Conceptually, the model simply expresses the relationship between three items: Firm Value (P), Book Value (B), and Future abnormal earnings, such that:

Pt = Bt + PVFAE where,

PVFAE = Present Value of Future Abnormal Earnings

or:

$$\textbf{PVFAE} = \sum_{t} \frac{E_t - (r_e x B_{t-1})}{(1 - r_e)^t}$$

If a firm could only earn a normal return equal to its cost of equity capital on its book value, then abnormal earnings would be zero. Thus, P_t would equal B_t; there would be no reason for investors to value a firm (P_t) above its current book value (B_t). Firm value should exceed book value only to the extent of future abnormal earnings that could be generated on the book value. The degree to which P_t exceeds B_t would depend upon the amount and timing of the expected abnormal earnings.

These same relationships introduced in Equation (1) can be expressed in terms of rates of return, where:

Normal rate of return = r_e

Actual Expected rate of return = ROE_t = $\frac{E_t}{B_{t-1}}$

And:

Abnormal rate of return = $AROE_t$ = ROE_t - r_e

Thus, Equation (1) can be rewritten in terms of Rates of Return (ROE)as in Equation (2) below:

$$P_0 = B_o + \frac{(ROE_1 - r_e)}{(1+r_e)}B_0 + \frac{(ROE_2 - r_e)}{(1+r_e)^2}B_1 + \frac{(ROE_3 - r_e)}{(1+r_e)^3}B_2 \ldots \qquad (2)$$

or in terms of Abnormal Rates of Return (AROE) in Equation (3):

$$P_0 = B_o + \frac{(AROE_1)}{(1+r_e)}B_0 + \frac{(AROE_2)}{(1+r_e)^2}B_1 + \frac{(AROE_3)}{(1+r_e)^3}B_2 \ldots \qquad (3)$$

In this formulation, the numerator terms of the model are nothing more than the abnormal rate of return times the book value. The denominators discount the abnormal earnings by the appropriate discount rate, the cost of capital. Note that Equation (2) is a most general representation of the model. It permits different ROE's in different periods, changing book values (B_t) in different periods, and further permits abnormal earnings to persist indefinitely.

C. MODEL TRANSFORMED

An integral part of this research involves transforming the standard EBO model from its original purpose of forecasting stock price to forecasting abnormal returns of a firm. Ultimately, this is accomplished by rearranging the terms in the original model to solve for AROE instead of firm value. Since abnormal earnings may signal monopoly power, the model provides a procedural tool to analyze defense firms pre and post-merger.

There are two steps in solving for AROE. The first is a straight forward conceptual transformation based on the idea that:

Firm Value - Book Value = Present Value of Future Abnormal Earnings

or:

$$\mathbf{P_t - B_t = PVFAE}$$

The second requires answering the question: If the present value of future abnormal earnings (PVFAE) is known, how can the annual rate of abnormal return (AROE) be determined? For any single value for PVFAE, there are an unlimited number of patterns for future earnings that could produce the given PVFAE. Those patterns would result from various combinations of r_e, B_t and ROE_t extended over various future years. Transforming PVFAE into a yearly measure of AROE requires four assumptions; 1) the security market is efficient, 2) annual return on equity is constant, 3) book value grows at

a constant rate, and 4) monopoly power implies the ability to earn abnormal earnings indefinitely.

1. The Security Market is Efficient

Market stock prices (P) can be used as the fair value or intrinsic value of a firm if the Efficient Market Hypothesis (EMH) is assumed to hold. EMH states that stock prices accurately reflect all available information about the firm (Dyckman & Morse, 1986). Therefore, a firm's stock price reflects the investors' best evaluation of a firm's earning power by discounting earnings (and dividends) into the current market value of the stock. Hence, current market price can be used to determine a fair measure of PVFAE.

2. Annual Return on Equity is Constant

The EBO model permits ROE to change over time (ROE_1, ROE_2, etc. in equation 2) without restriction. When using the EBO model in its original form to estimate intrinsic value, a single value (P_0) can be determined from any set of future returns (ROE_1, ROE_2, etc.). Normally, ROE is estimated using individual yearly earnings forecasts generated by independent securities analysts. Therefore, the EBO model permits changing yearly values for ROE.

In this application, constant ROE is assumed from a practical purpose. It permits a single ROE measure to be determined from a single PVFAE measure. Without this assumption, the calculation of a single annual return figure

is not possible. Given this assumption: $ROE_1 = ROE_2 = ROE_3$, etc., and $AROE_1 = AROE_2 = AROE_3$, etc.

3. Book Value Grows at a Constant Rate

The EBO model permits book value to change over time (B_0, B_1, B_2, etc. in equation 2) without restrictions, except that $B_t = B_{t-1} + E_t - D_t$. The rate at which B_t grows depends upon $E_t - D_t$, the portion of earnings retained or not paid out as dividends. For simplicity, and following typical usage, the rate of growth in book value is assumed constant. Growth for this model reflects the portion of earnings that are reinvested as retained earnings by the firm and show up in the book value. This is equivalent to assuming a constant dividend payout rate and a constant retention rate. The following notation is consistent with these assumptions:

k = Dividend payout rate

(1-k) = Retention rate = (E - D)/E

g = growth rate of B = (1-k)*ROE

Rewriting equation (2) incorporating the assumptions of constant ROE and g renders Equation (4):

$$P_0 = B_0 + \frac{(ROE - r_e)}{(1+r_e)}B_0 + \frac{(ROE - r_e)}{(1+r_e)^2}B_0(1+g)^2 + \frac{(ROE - r_e)}{(1+r_e)^3}B_0(1+g)^3 \ldots \quad (4)$$

Substituting AROE for $(ROE-r_e)$, dividing by B_0, and subtracting 1 from each side of Equation (4) leads to Equation (5).

$$\frac{P_0}{B_0} - 1 = PVFAE = \frac{(AROE_1)}{(1+r_e)} + \frac{(AROE_1)(1+g)}{(1+r_e)^2} + \frac{(AROE_1)(1+g)^2}{(1+r_e)^3} \ldots \qquad (5)$$

4. Monopoly Power Implies the Ability to Earn Abnormal Earnings Indefinitely.

The general EBO model accommodates all assumptions regarding the period of time over which abnormal earnings may be expected to exist. The model can represent a perpetuity or stop at a finite number of years depending on the assumptions used. For example, Lee (1996) uses analyst's earnings forecasts to project growth in ROE. Normally, he allows the ROE rate to revert to the industry average after the eighth year of forecasts. This is consistent with abnormal returns being eroded away as other firms innovate or enter a competitive market.

All firms have the ability to earn some level of abnormal earnings in the short run until market forces revert to equilibrium. This version assumes a competitive market with no entry restrictions. In a truly competitive market, a firm should always generate an ROE equal to its cost of capital, in perpetuity. In contrast, a firm with monopoly power would be able to restrict competition, resist

the forces which would return earnings to normal, and hence generate abnormal earnings indefinitely. This idea is consistent with abnormal returns being a perpetuity as in the EBO model. Thus, this research assumes that defense firms will earn abnormal earnings in perpetuity due to the difficulty competitors have entering the market.

If AROE is treated as existing indefinitely, a perpetuity, then the right hand side of Equation (5), PVFAE, simplifies algebraically to Equation (6).

$$\frac{P_0}{B_0} - 1 = PVFAE = \frac{(AROE)}{r_e - g} = \frac{(ROE - r_e)}{r_e - g} \qquad (6)$$

Solving Equation (6) for ROE transforms the model into equation (7), a form that provides an annual value for return based on the expectations embedded in the stock price. Equation (7) is the basis for the research and will be applied to assess the changes in returns for defense firms involved in merger activity.

$$ROE = \frac{r_e * P}{B + (1 - k)(P - B)} \qquad (7)$$

Subtracting the cost of capital from the ROE in turn measures the abnormal portion of return.

$$\mathbf{AROE_t = Abnormal\ return = (ROE_t - r_e)}$$

Therefore, the basic variables required to solve for abnormal return consist of: stock price, dividend payout ratio, book value, and cost of capital.

D. SUMMARY

EBO is a proven accounting valuation model that focuses on wealth creation not wealth distribution. Monopoly power manifests itself in the ability of firms to command abnormal earnings. The transformed version of the EBO model provides the tool to segregate abnormal earnings of defense firms. Chapter IV discusses the methodology for conducting the research which will analyze abnormal returns of defense firms involved in merger activity for monopoly power.

IV. METHODOLOGY

A. OVERVIEW

This chapter explains the methods used to conduct the research. Data analysis was conducted in five steps. First, an investigation of monopoly power required a method to measure the abnormal earnings of defense firms. Chapter III discussed the model selected for this purpose. Transforming the EBO model provided a usable tool for the analysis and guided the data collection phase of the research. Second, a sample of defense firms involved in major mergers was selected. Third, market data, industry data and financial data from these firms was collected from various sources and entered onto spreadsheets to calculate variables needed for the EBO model. Fourth, the data was smoothed and made consistent across the population for inclusion in the model. Finally, abnormal earnings were calculated for each firm and analyzed between periods in the merger process.

B. SAMPLE FIRMS AND MERGER EVENTS

1. Sample Identification

Since the objective of this research was to analyze the impact of defense industry mergers, the sample selection focused on the aerospace and defense industry group as listed by such investment resources as Value Line and

Forbes. The primary criteria for selecting the sample are listed below:

- Only merger/acquisitions with a dollar value over $2 billion were included.
- Each firm prior to the merger derived over 25% of its revenue from defense related sales (Defense News 1995, 1996, & S&P 1993, 1994).
- Each firm prior to the merger was among the top 20 U.S. defense firms measured by total defense sales for the year analyzed (Defense News 1995, 1996, & S&P 1993, 1994).
- Firms were separate public companies with individual stock prices before and after the merger.
- The merger announcement occurred no earlier than 1994.

These restrictions limited the sample size because many acquisitions involve only the defense segments of a larger company. For example, Northrop Grumman's $3.6 billion acquisition of Westinghouse Electronic Systems in 1996 was not analyzed since no separate financial data or stock price existed for that division of Westinghouse. Based on the above criteria, seven merger/acquisition events were selected involving 12 separate firms. By August 1997, the 12 initial firms had consolidated into only five with two more mergers still pending. Table 2 lists the selected firms and includes the date of the announcement and effective date the merger was completed. The quoted value is the total amount of stock, cash or combination of the two the acquiring firm

paid for the acquiree. Acquiring firms are listed above the acquiree. The right side of the table shows the name of the merged firm.

Table 2. Selected Mergers/Acquisitions

Selected Mergers/Acquisitions			
Firm/(Symbol)	Date Announced	Date Merged	Firm/(Symbol)
Northrop Corp. (NOC) Value: $2.1B **Grumman Corp. (GQ)**	10-Mar-94	15-May-94	**Northrop Grumman (NOC)**
Lockheed Corp. (LK) Value: $9B **Martin Marietta (ML)**	30-Aug-94	15-Mar-95	**Lockheed Martin (LMT)**
Raytheon (RTN) Value: $2.3B **E-Systems (ESY)**	3-Apr-95	8-May-95	**Raytheon (RTN)**
Lockheed Martin (LMT) Value: $7.6B **Loral (old) (LOR)**	7-Jan-96	29-Apr-96	**Lockheed Martin (LMT)**
Boeing (BA) Value: $13.3B **McDonnell Douglas (MD)**	15-Dec-96	4-Aug-97	**Boeing Company (BA)**
Raytheon (RTN) Value: $9.5B **Hughes Electronics (GMH)**	16-Jan-97	NA	**Raytheon (RTN)**
Lockheed Martin (LMT) Value: $11.6B **Northrop Grumman (NOC)**	3-Jul-97	NA	**Lockheed Martin (LMT)**

2. Time Period Covered by the Merger Sample

Prior to 1994, no merger of publicly traded defense firms was valued above $2 billion. Table 1 in Chapter II

listed 38 notable defense mergers since 1994. Of those, 24 did not involved separately traded public companies and 28 were below the $2 billion threshold. The selected sample represents all mergers above $2 billion since 1994 that could be analyzed using stock prices. The $2 billion value cap is justified by the need to analyze large defense companies and also to keep the sample size within the scope of data collection constraints.

C. STRUCTURE OF THE ANALYSIS

Mergers occur at different times and span varying periods of time before they are consummated. Even after they are consummated, activities are on going in both firms to combine their operations. With that in mind, mergers become an ongoing process rather than a single event. This trait required that certain stages in the merger process be defined for analysis. The stages chosen are listed below.

- Premerger Period
- The Announcement Date (Immediate effect)
- Interim Period (Fully digested effect)
- Post-Merger Period 1 (Immediate expectation of new firm)
- Post-Merger Period 2 (Slightly digested expectation of the firm)

In addition to identifying the process each merger undergoes, time constraints for the pre and post-merger

stages were specified to make analysis of each one consistent. Figure 4 illustrates this concept though a timeline approach.

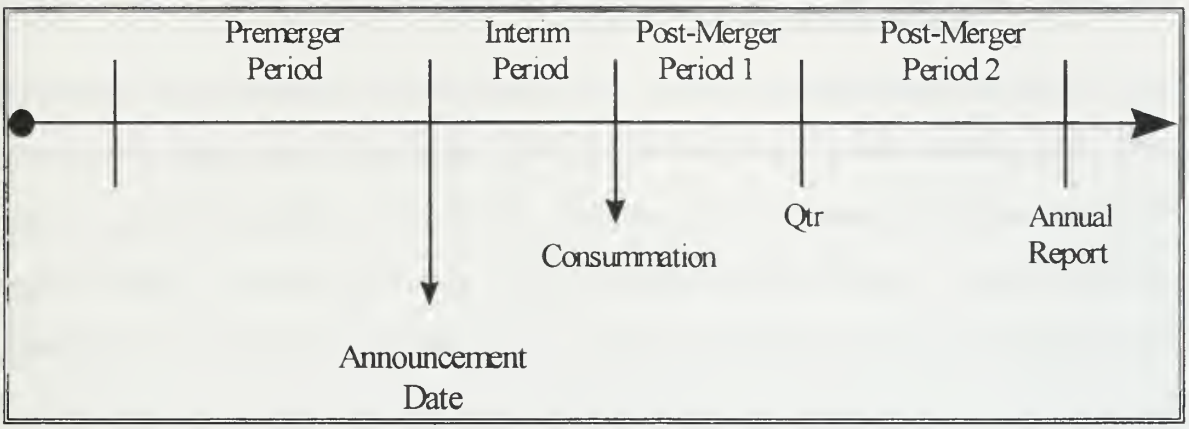


Figure 4. Merger Event Timeline

Each stage along the timeline offers a new set of data to base the analysis of abnormal earnings for the firms involved in the merger process. Excel spreadsheets were constructed to evaluate the value of each firm's abnormal earnings over the merger stages. The following discussion describes the merger stages and presents a methodology for choosing them.

1. Premerger Period

The pre-merger period was constrained to the trailing three months prior to the announcement date. This period provided enough data for use in the EBO model and reflected the most recent status of the firms' book value, stock price, and cost of capital just prior to the merger

announcement. The research assumes data from this period, particularly stock prices, are "clean" of the affects of information about the pending merger.

2. The Announcement Date

The announcement date is the point where the market officially becomes informed of a forthcoming merger. Merger announcements send signals to the market. If the announcement is anticipated by the market, then the information has no affect since the knowledge of the merger is already reflected in the stock price (value) of the firms involved. When the announcement is not anticipated, the content of that information causes immediate reaction in the market. Investors reassess the future earnings prospects of the firms involved and stock prices change accordingly. Therefore, it makes sense to evaluate what effect, albeit "immediate", the announcement information had on the market and the investors' expectations of a firm's ability to earn abnormal returns. To capture this effect requires a comparison of abnormal earnings before the merger announcement with abnormal earnings assessed the date investors could act on the knowledge of the merger announcement information.

3. Interim Period

The interim period was defined as the period between the merger announcement and the consummation of the merger.

The length of this period varied from merger to merger. This period is significant in the sense that the time before the consummation gives investors opportunity to "digest" the news of the merger and change their assessment of firm value. An assessment of abnormal earnings during this period would likely differ from the assessment at the moment of the announcement. This difference would represent the market adjusting its expectations of future abnormal earnings of the participating firms as a result of "fully digesting" information concerning the forthcoming merger, rendering a more accurate measurement for analysis. The two most recently planned mergers between Raytheon and Hughes Defense and Lockheed Martin and Northrop Grumman are still in the interim stage. Data up to 30 September 1997 was used for the analysis for these two mergers.

4. Post-Merger Period 1

The first post-merger period is defined as the time between the consummation of the merger and the ending date of the new firm's next quarterly financial report. The merger is not over until the new firm absorbs the plants, equipment, and employees of the acquired firm. The post-merger period then could be six months, one year, or five years depending on how long that takes. However, the market anticipates these events and values a firm accordingly. The first data available for the newly merged firm will permit a

fair initial assessment of the expected abnormal earnings. However, using the same line of reasoning applied earlier to the measurement at the announcement date, this period would render a "first impression" or "immediate" reaction to the new firm by the market.

The new firm at this point is probably struggling with a new capital structure, redundant facilities and functions, and differing corporate cultures. No doubt, the market will recognize this to some extent, but uncertainty about the future may be high.

(Boeing's post-merger results with McDonnell Douglas are only available through this period.)

5. Post-Merger Period 2

A second post-merger period was defined to provide a more "digested" measure of abnormal earnings later on the timeline. The period is short enough to isolate affects of the individual merger analyzed yet long enough to allow the new firm to absorb the acquired firm and restructure at least some of it's processes. The second period begins at the end of period one and extends to the new firm's first annual report. This period allows for at least six months of data from four of the seven mergers.

Several firms analyzed from the sample have engaged in more than one merger. Subsequent mergers by the same firm provided an extended sequence of observations over time for

that firm. For instance, post-merger results exist for the Lockheed/Martin Marietta merger in 1995. The new Lockheed Martin also has abnormal returns calculated from 1996 data for analysis with the Loral merger. In addition, Lockheed Martin has abnormal earnings calculated from 1997 data for the Northrop Grumman deal. Other observations of abnormal earnings from subsequent mergers can be used with Raytheon and Northrop Grumman to assess the longer term effects of their merger activity over time.

D. DATA COLLECTION

Data collection focused on two themes: 1) what data to use, and 2) from what time period was it to be collected. First, the data had to provide values for the variables of the transformed EBO model. Chapter III described these variables as: stock price, cost of equity capital, book value, and dividend payout ratio. Second, the data had to provide values for the variables for each of the five stages in the merger process outlined above. The following sections describe the types of data collected and sources.

1. Stock Prices

Stock prices for currently traded firms were fairly easy to attain from Internet charting and quote services (DLJdirect, 1997). Media General Financial Services provided monthly stock price data on S&P 500 companies current until April 1997 (MEGA Insight, 1997). Finding

historical stock price information for "Dead Wood" companies, those that were merged with other firms and ceased to trade publicly, proved more difficult.

Once a company is de-listed from an exchange, most Internet quote services drop the symbol and the associated data. Reference publications such as Moody's, S&P Stock Encyclopedia and Value Line only list stock prices of firms in yearly or quarterly high and lows. This gap in data required a detailed search of the Wall Street Journal on microfilm dating back to 1994 to capture price data for the earlier mergers.

2. Cost of Capital Data

Theoretically, the cost of equity capital consists of two components, a risk free rate and a risk premium, specific to an individual firm. The cost of capital and its calculation is discussed in more detail later in the chapter, but data collection related to both components was necessary.

a. T-Bill Rates

The analysis used three month treasury bill (T-bill) rates for the risk free rate of return in the cost of capital calculation. The US Dept. of Treasury maintains an historical listing of all bill and bond yields at their Internet World Wide Web site (DOT, 1997). Although some data was available for weekly auctions of the T-bill, the

same level of detail was not provided previous to 1995. Also, most of 1997's data was not posted on the Treasury's Web Site. Charles Schwab Investor Services On Line provided treasury rate data the most recent yields through its information agreement with First Call. Appendix (B) contains a listing of the average monthly three month treasury bill yields used for the cost of capital calculation.

b. Industry Risk Premium Data

The analysis used a comprehensive list of risk premiums calculated for individual industry groups according to their Standard Industrial Code (SIC)(Woolley, 1997). Moody's Profiles of S&P Companies on CD ROM, found in the Knox Library, contained the best listing for SIC codes for the sample defense firms. However, different rating systems characterize a firm's business differently. It is not accurate to group a single firm into one SIC since it may pursue diverse lines of business. This is the case with all defense firms analyzed. Therefore, a composite risk premium was calculated to derive the cost of capital. The method used is described later in this chapter.

3. Book Value

The book value of the selected firms was calculated by subtracting the sum of the total liabilities and preferred stock (if any) from the accounting value assigned to its

total assets. This value was divided by the number of fully diluted shares outstanding to render the book value per share. The firm's financial data was taken from the balance sheet on relevant quarterly and annual reports. All firms responded to the researcher's request for hard copies of current and previous financial reports. Where gaps in the data existed, the Securities and Exchange Commission's (SEC) World Wide Web EDGAR database provided many of the essential company reports, in some cases dating back to 1994 (SEC, 1997). Other sources included historical data from Value Line and S&P Company Profiles for the "Dead Wood" firms (Value Line, 1994, & S&P, 1993-1996).

4. Dividend Payout Ratio

The dividend payout ratio is the percentage of net income the firm pays out in the form of dividends. It was used to calculate the constant growth rate for the EBO model based on historical data. The dividend payout ratio is calculated by dividing the dividend paid in a given reporting period by the net income or earnings in the same period. Financial data was taken directly from the firm's Income Statement, when available, and from historical data published in the S&P Stock Market Encyclopedia (1993-1996) and Value Line (1994). The historical growth rate used in the analysis was calculated using annual financial data since 1990, as discussed later in the chapter. (The company

data tables in Appendix B show the dividend payout ratios for the ending date of the corresponding annual and quarterly periods. However, this figure is provided for reference only.)

E. NORMALIZING EBO MODEL INPUTS

The company data sheets in Appendix B contain raw accounting data from specific points in time, (e.g., the ending date of the financial reporting period). Each variable used in the EBO model was normalized using a standard method to represent a value for a given period of time during the merger process. Therefore, the resulting abnormal return calculated from the transformed EBO model is designed to represent a value for a period of time, one of the stages in the merger process, rather than a single specific point in time. Specific methods used for each EBO variable are discussed next. Individual firm Abnormal Earnings Worksheets contain the actual inputs and final results of the applied EBO model. Chapter V contains these worksheets.

1. Price

The closing market stock price was used only for the announcement date. The price was taken from the first full trading day after the merger announcement was made public. In some cases, the announcements were made at the close of

trading on Friday or over a weekend. Therefore, the closing price from the following Monday was used.

In all period calculations, the model used an average stock price. Stock prices were averaged using one of two methods depending on the time period.

1) For periods of three months or greater:
   - -Average of firm's monthly high and low price
   - -Average of the monthly averages calculated
2) For periods less than three months:
   - -Average of firm's weekly high and low price
   - -Average of the weekly averages calculated

In situations where merger events did not fall neatly at the end of the month, weekly price data filled the gap to the nearest whole month. Therefore, some calculations are a combination of averaged weekly price data and averaged monthly price data.

2. Cost of Capital

The cost of equity capital (r_e) consists of two components:

Cost of Capital (r_e) = Risk free rate + Risk premium

The cost of equity capital (r_e) differs between industries and individual firms. In theory, measures of r_e should be firm specific, but "there is little consensus on how this discount rate should be determined" (Frankel & Lee, 1996, p. 8). For this study, the cost of equity capital (r_e) used

risk premium values for major SIC's that Lee provided with the Internet version of Woolley's (1997) Forbes article. Lee used an established investment model, the Capital Asset Pricing Model (CAPM), to compute a risk premium for different industries (Woolley, 1997). Adding this risk premium to the yield on a 3 month treasury bill (the risk free rate), renders a fairly accurate cost of equity capital for a firm (Lee, 1996).

In this research, since all firms in the sample conducted business in several major SIC's, a composite risk premium was calculated for each firm based on sales volume. The risk free rate incorporated an average of the three month T-bill rate in keeping with Lee's usage of the CAPM model.

a. Composite Risk Premium

The composite risk premium was calculated as a weighted average of the industry risk premiums for the SIC codes in which a firm operated, using the firm's percentage of sales in certain lines of business. Percentage of sales best represents the firm's resources devoted to those markets. Sales data was taken from annual reports and S&P company profiles (S&P, 1993-1996). Table 3 contains Grumman Corp.'s SIC codes, percent of sales by SIC code, Lee's risk premium for each SIC code, and the composite risk premium.

Composite risk premiums for all sample firms and a description of each code is contained in Appendix B.

Table 3. Sample Composite Risk Premium Calculation

Company	S.I.C. Codes	Percent of Sales	SIC Risk Premium	Composite Risk Premium
Grumman Corp.	3721	54%	0.0614	**6.609%**
1993	7300	18%	0.0622	
	3812	18%	0.0681	
	3713	10%	0.0948	

Table 3 demonstrates that Grumman Corp.'s composite risk premium is higher than if attributed only to SIC 3721 (Aircraft), its dominant line of business. The composite captures the portion of a firm's business with a higher or lower risk premiums.

These composite risk premiums assume no major change in lines of business during a year, except when the merger is consummated. At this point, the new firm's percentage of sales in each line of business will change. Therefore, post-merger periods used the risk premium calculated from data of the combined firm's first annual report following the consummation. For the periods prior to the consummation date, the original firm's risk premium was calculated from its last annual report and was projected forward.

In Boeing's recent merger with McDonnell Douglas, Boeing's post-merger risk premium was calculated by averaging the two firms premerger risk premiums, since no new sales data existed. This assumes that Boeing simply added McDonnell Douglas's business lines to theirs.

b. Risk Free Rate

The risk free rate was based on the three month T-bill yield. Three month T-bills are sold four to five times per month. Each auction renders bills with slightly different discount rates and yields depending on market rates. Data for the average monthly T-bill yield from 1993 to September 1997 was collected.

The objective, consistent with measures of price and book value, was to use a risk free rate associated with each merger stage. Time periods of each stage varied and T-bill yields changed daily. Therefore, the analysis identified the last day of each merger stage as a starting point for calculating the risk free rate. An average of the monthly T-bill yield during the three months previous to the end date of the merger stage was calculated.

Whole month T-bill yields were used if a merger stage's end date fell plus or minus ten days from the first of the month. Otherwise, the weighted average for the fraction of a month was determined and then the trailing three month average was calculated. For example, the

Lockheed and Martin Marietta merger was consummated on 15 March 1995, ending the interim period. The risk free rate used for that period was the sum of; (.5)(average March yield) + (average February yield) + (average January yield) + (.5)(average December yield), divided by three. The trailing three month average approach standardized the risk free rate calculation across all merger stages.

3. Book value

A firm's book value changes constantly based on operating, financing and investment activities. Book value calculated directly from accounting data in financial statements represents a value only for the ending date of the report. The objective in normalizing Book Value (Bv) was twofold: 1) to project a reasonable estimate for Bv at the merger announcement, and 2) to calculate an average Bv_{avg} across periods of the merger event. Since both price (P) and Bv are critical variables in the EBO model, accurate results depended on both inputs meeting up at the same point in time. In other words, if the closing price was used on the merger announcement date, then there should exist a specific book value on that date as well. Similarly, when P is averaged over a period, Bv should also be averaged over the same period.

This research used a single method to estimate both point Bv's (for announcement date) and Bv_{avg} (for merger

event periods). First, the change in book values from adjacent financial reports closest to the announcement date or end date of the merger event period was calculated. Second, depending on the period of time involved, Bv's were extrapolated forward to the target dates of the merger event using the change between periods as the slope of a line and the beginning period's book value as the y-intercept. Figure 5 illustrates this process as a function of time.

Values in the graph are the actual data used for calculating Lockheed Martin's point and average book values. The book values for 31 March and 30 June are $31.56 and 32.63 respectively. The change in book value between these two quarterly periods is used to extrapolate a point book value for 7 April ($31.64) and 7 July ($32.71). The book value of $32.71 was used to calculate abnormal earnings for Lockheed Martin as of the merger announcement date with Northrop Grumman. The premerger period book value was calculated by taking the average of the two point values on 7 April and 7 July; the three month period before the announcement date. This value is represented on Figure 5 as Bv_{Avg}, $32.18.

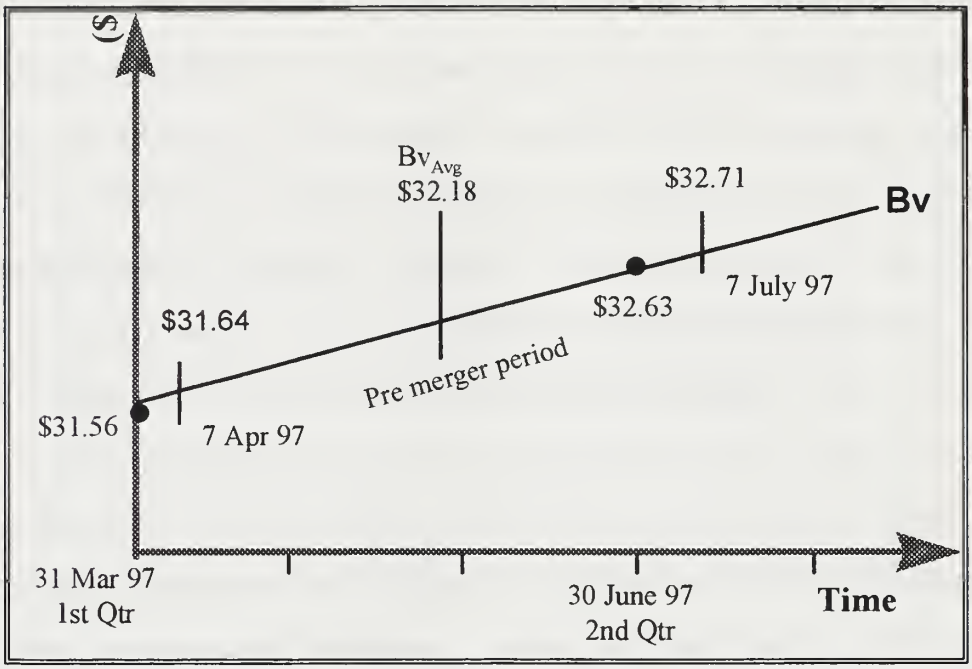


Figure 5. Extrapolating Book Value

Finally, either the point estimate Bv was applied to the model for specific date calculations or the average between the merger period beginning and end date Bv's was calculated. Utilizing a spreadsheet simplified this rather straightforward process.

All book values used in the analysis were extrapolated unless the merger event date took place plus or minus 5 days from a quarterly or annual report. For example, Raytheon announced its plans to acquire E-Systems on 3 April 1995, only three days from the end date of their 31 March 1995 quarterly report. In this case, the Bv calculated directly

from the 31 March financial statement was used as the measure of Bv for 3 April, the merger announcement date.

4. Growth Rate/Dividend Payout

Recall from Chapter III that the EBO model uses the firm's earnings retention rate as the measure of growth in book value and retention rate is a direct result of dividend payout policy. A firm's dividend policy is typically consistent in dollar amount. Therefore, fluctuations in the payout ratio usually depends on fluctuations in earnings.

Annual historical annual data since 1990 was used to calculate the annual dividend payout ratio. The retention rate was then calculated and averaged over the years since 1990. Years with negative earnings were eliminated for the calculation. A negative earnings year is most likely a result of extraordinary charges against income and not normal for a going concern. This variable was the only one that relys on data prior to the merger in the calculation.

The newly merged firms without a dividend payout history were more difficult to assign a retention ratio. The research assumed they would follow the same policy as the acquiring firm. Data from Lockheed Martin and Raytheon support this view since their payout ratios remained relatively constant after acquiring Loral and E-Systems respectively. Individual spreadsheet calculations for the

historical growth rates (retention rate) used in the analysis are contained in Appendix B.

F. SUMMARY

A population of twelve firms and seven large, defense industry mergers was selected for analysis. Data was collected from a diverse set of sources including; established investment reference publications, company financial statements, government databases, periodicals, and the Internet. This chapter introduced the merger event timeline as a basis for the empirical research. The research methodology made every attempt to normalize all data across the merger periods and between sample firms.

Chapter V introduces each sample firm, presents the resulting abnormal earnings expected for those firms over the range of each merger event, and analyzes those results in terms of monopoly power.

V. DATA PRESENTATION AND ANALYSIS

A. OVERVIEW

This chapter is divided into two interrelated sections, data presentation and data analysis. The data presentation section chronologically describes each merger and provides a discussion of the participating firms. It outlines the dates for the merger stages and characterizes each firm in terms of its products and size by revenue and percent of defense sales. The sample mergers' Abnormal Rates of Return on Equity (AROE) resulting from the transformed EBO Model are presented for each merger stage.

The Data Analysis section makes observations and interprets the resulting abnormal return in terms of quantifiable changes between stages in the merger process. The analysis identifies patterns of resulting AROE measures and draws conclusions concerning the mergers effect on expectations for future abnormal returns.

B. DATA PRESENTATION

This section describes each merger in the sample and characterizes the firms involved. First, each description identifies the dates of the merger event, the value or price paid for that merger or acquisition, and the method of accounting used. Second, each firm is "sized" in terms of total annual revenue and percent defense sales. Also, a

summary of their major defense programs introduces the reader to the firm's business activities (this relates directly to the firm's SIC code). Next, the post-merger firm is "sized"; again in terms of total revenue and defense sales. Unusual circumstances are also mentioned if applicable. Finally, the resulting AROE data for each merger is presented.

Many numbers and percentages are mentioned in this section. For ease of presentation and reading, these items are not cited separately. Rather, a summary of the data sources is listed in Table 4. In all cases where data was taken from an alternate source, that source is cited within the text.

Table 4. Summary of Data Sources

	FINANCIAL REPORTS (10K & 10Q)	S&P (1993-1996)	VALUE LINE (1994 & 1997)	DEFENSE NEWS (1995, 1996)	ZEGLEY, (1997)
Merger Dates	✓				
Merger Form (Stock/Cash)	✓				
Acquisition History	✓				
Annual Revenue	✓	✓	✓	✓	
% Defense Sales	✓	✓	✓	✓	
Company Products	✓	✓	✓		✓
Major Defense Programs	✓	✓	✓		✓

1. Northrop Acquires Grumman

Northrop Grumman Corp. (NOC) was created when Northrop Corp. completed its merger with Grumman Corp. by purchasing its outstanding shares for $2.17 Billion or $62 per share. Northrop was not the first to express interest in buying Grumman. Martin Marietta initially offered $55 per share for Grumman on 7 March 1994. Fearful of losing its core position in the declining defense market (B-2 bomber), Northrop counter-offered $60 per share on 10 March 1994. After negotiations between the two companies, Northrop sweetened the bid to $62 per share on 4 April which was accepted by Grumman stockholders. Grumman's shares ceased trading after Friday, 15 April 1994 once Northrop had tendered 93.4 percent of Grumman's stock. The merger was officially consummated with the SEC on 18 May 1994; the shortest interim period of the seven mergers analyzed.("Northrop Says", 1994)

Grumman Corp. designed and manufactured military aircraft, space systems, electronic systems, and provided information services. Approximately 90 percent of Grumman's $3.2 billion 1993 revenue was in defense sales. In 1993, Grumman's major programs included: production of the EA-6B and E-2C Hawkeye, upgrade work to its F-14 and A-6 aircraft, development of the E-8A Joint STARS, electronics for aircraft, and computerized test equipment. Grumman also fabricated and sold aluminum truck bodies.

Northrop Corp. produced 40 percent of the components for the F-18 aircraft, manufactured the B-2 aircraft, and made fuselages for the 747 airliner. Total revenue in 1993 was $5 billion with 90 percent going to defense sales. Electronics and communication activities made up 12 percent of sales which included the design and construction of broadcasting stations, and manufacturing avionics for aircraft and missiles. Northrop's B-2 production accounted for 50 percent of sales in 1993 and a total production of 20 aircraft was to be completed in 1997.

Northrop Grumman restructured into five segments during 1994; military aircraft, B-2 stealth bomber, electronics and systems integration, commercial aircraft, and data systems. The merged firm had total revenue of $6.7 billion in 1994 and ranked fourth in U.S. defense revenue for that year. Table 5 provides the variables used for the Northrop, Grumman merger with the resulting AROE expressed in percentage terms.

Abnormal Earnings Worksheet

Northrop Acquires Grumman

	Premerger Period		Announcement (1)		Interim Period		Post-Merger	
	Northrop	Grumman	Northrop	Grumman	Northrop	Grumman	Northrop	Grumman
	7-Dec-93 to 4-Mar-94		4-Apr-94		5-Apr-94 to 15-Apr-94		18-Apr-94 to 30-Jun-94	30-Jun-94 to 31-Dec-94
EBO Variable								
Closing Stock Price (P)			$ 37.63	$ 61.69				
Period Stock Price (P_{ave})	$ 39.00	$ 38.75			$ 38.13	$ 61.88	$ 37.13	$ 42.27
Book Value/Share (Bv_{ave})	$ 27.18	$ 24.48	$ 27.70	$ 24.03	$ 27.78	$ 23.97	$ 28.49	$ 27.43
Historical Growth (1-k)	54%	55%	54%	55%	54%	55%	63%	63%
Cost of Capital (r)	9.347%	9.809%	9.807%	10.269%	9.637%	10.099%	10.457%	10.751%
P minus Bv	$ 11.82	$ 14.27	$ 9.93	$ 37.66	$ 10.35	$ 37.91	$ 8.64	$ 14.84
ROE	10.86%	11.78%	11.16%	14.22%	11.01%	14.00%	11.44%	12.36%
Abnormal Return (AROE)	1.514%	1.974%	1.354%	3.949%	1.374%	3.903%	0.985%	1.605%

Note (1) : Martin Marietta submits bid to acquire Grumman for $55 per share on 7 March
Northrop enters a counter-offer bid of $60 per share on 10 March.
Northrop sweetens the offer to $62 per share which is accepted by Grumman stockholders on 4 April 1994.

Table 5. Northrop, Grumman Merger Results

2. Lockheed Corp. Merges with Martin Marietta

Lockheed Martin (LMT) is a result of Lockheed Corp. (LK) merging with Martin Marietta (ML) on 15 March 1995 with the issuance of new LMT stock worth $9 billion. Lockheed stockholders received 1.63 shares of new LMT stock for each share of Lockheed, while Martin Marietta stockholders received new LMT shares on a 1:1 basis. The merger was announced on Monday, 29 April 1994 after the close of trading. LMT began trading on 15 March 1995 when the merger was consummated.

Martin Marietta's strength was in electronic systems found in many weapons systems. Total revenue in 1994 was $9.8 billion, 80 percent of which was to defense sales. Martin Marietta's major programs included: the Titan and Atlas space launch vehicles, satellite and spacecraft systems (including the external tanks for the space shuttle), missiles, defense electronics encompassing navigation and targeting systems, ship combat systems, radar and control systems. They were also a major aircraft component manufacturer and assembler.

Lockheed Corp.'s strength was in assembly of aircraft and other weapons systems. Total revenue in 1994 was $13 billion with 64 percent going to defense sales. Lockheed's major programs included: the F-16 and F-22 fighter aircraft, F-117A stealth fighter, C-5, C-130, C-141 transports, P-3 anti-submarine aircraft, various classified defense

programs, Trident submarine launched missile, Milstar satellites, and other space programs.

Both companies had an acquisition strategies prior to this merger. Lockheed purchased General Dynamics fighter aircraft business in 1993 for $1.52 billion. Martin Marietta acquired General Electric's aerospace division for $3.05 billion in April 1993, and General Dynamics space systems division in December 1993 for $208 million.

Lockheed Martin's 1995 annual report recorded total revenues of $22.8 billion. Lockheed Martin became the number one defense firm worldwide when ranked by defense sales for 1995 with $14.3 billion.

Appendix B contains annual data for 1993 and 1994 from both firms. Quarterly reports were unavailable from 1994, but six month data from June 1994 was used to extrapolate book value for the premerger period and announcement date. Table 6 provides the variables used for the Lockheed, Martin Marietta merger with the resulting AROE expressed in percentage terms.

Table 6. Lockheed, Martin Marietta Merger Results

Abnormal Earnings Worksheet

Lockheed merges with Martin Marietta

EBO Variable	Premerger Period		Announcement		Interim Period		Post-Merger	
	Lockheed	Martin	Lockheed	Martin	Lockheed	Martin	Lockheed Martin (LMT)	
	29-May-94 to 29-Aug-94		30-Aug-94		31-Aug-94 to 15-Mar-95		16-Mar-95 to 31-Mar-95	1-Apr-95 to 31-Dec-95
Closing Stock Price (P)			$ 76.75	$ 48.75				
Period Stock Price (P_{ave})	$ 64.21	$ 45.95			$ 74.46	$ 46.50	$ 52.97	$ 65.30
Book Value/Share (Bv_{ave})	$ 43.12	$ 21.55	$ 43.41	$ 22.17	$ 44.34	$ 24.23	$ 25.88	$ 26.55
Historical Growth (1-k)	65%	78%	65%	78%	65%	78%	65%	65%
Cost of Capital (r)	10.07%	10.21%	10.07%	10.21%	11.54%	11.68%	11.19%	10.862%
P minus Bv	$ 21.09	$ 24.40	$ 33.34	$ 26.58	$ 30.12	$ 22.27	$ 27.09	$ 38.75
ROE	11.38%	11.56%	11.88%	11.60%	13.44%	13.05%	13.63%	13.71%
Abnormal Return (AROE)	1.308%	1.351%	1.806%	1.392%	1.903%	1.863%	2.440%	2.847%

3. Raytheon Acquires E-Systems

Raytheon (RTN) completed its $2.3 billion purchase of E-Systems (ESY) on 8 May 1995. ESY stockholders were paid $64 per share in cash. RTN financed the acquisition mostly with new long term debt. ESY continued to operate as a wholly owned subsidiary of Raytheon. The merger was announced on 3 April 1995.

E-Systems was a major producer of advanced electronic systems and products for defense markets. Total revenue in 1994 was $2 billion; defense sales accounted for 89 percent. Many of the corporation's military programs were classified. Reconnaissance, surveillance, and intelligence programs accounted for over 60 percent of ESY's 1993 revenue. ESY also provided command and control systems for information gathering, data processing and display. The company made missile steering and tracking systems, and aircraft navigation aids. It also provided aircraft overhaul and maintenance services for the Air Force and commercial carriers.

In 1994, Raytheon operated in four distinct business; commercial and defense electronics, engineering and construction, aircraft, and major appliances. Its 1994 revenue was $10 billion with approximately 44 percent coming from defense sales. RTN's defense electronics division produced Stinger, HAWK and Patriot surface-to-air missile systems, Sidewinder, Sparrow, and AMRAAM air-to-air

missiles, radar and communication equipment. Its aircraft division made Hawker corporate jets, and Beech turboprops and small jets. The construction division built large power plants and petroleum refining facilities. Major appliance brand names include: Amana, Caloric, and Speed Queen.

Raytheon purchased E-Systems for its strong backlog in orders for reconnaissance, surveillance, and intelligence programs that were less sensitive to declines in defense procurement. In 1994, RTN purchased British Aerospace's Corporate Jet Division which added medium sized business jets to its product line.

RTN's 1995 annual report recorded total revenue of $11.7 billion; 34.2 percent to defense sales. The merged company was the seventh largest U.S. defense firm ranked by defense revenue.

Table 7 provides the variables used for the Raytheon, E-Systems merger with the resulting AROE expressed in percentage terms.

Abnormal Earnings Worksheet

Raytheon Acquires E-Systems

	Premerger Period		Announcement		Interim Period		Post-Merger	
	Raytheon	E-Systems	Raytheon	E-Systems	Raytheon	E-Systems	Raytheon	
	31-Dec-94 to 31-Mar-95		3-Apr-95		4-Apr-95 to 8-May-95		9-May-95 to 30-Jun-95	1-Jul-95 to 31-Dec-95
EBO Variable								
Closing Stock Price (P)			$ 35.88	$ 64.00				
Period Stock Price (P_{ave})	$ 34.25	$ 42.95			$ 36.31	$ 63.80	$ 38.28	$ 42.36
Book Value/Share (Bv_{ave})	$ 15.69	$ 24.96	$ 16.49	$ 25.29	$ 16.36	$ 25.24	$ 16.76	$ 17.38
Historical Growth (1-k)	73%	70%	73%	70%	73%	70%	73%	73%
Cost of Capital (r)	11.69%	12.18%	11.69%	12.18%	11.78%	12.14%	11.60%	11.311%
P minus Bv	$ 18.56	$ 17.99	$ 19.39	$ 38.71	$ 19.95	$ 38.56	$ 21.52	$ 24.98
ROE	13.70%	13.93%	13.69%	14.88%	13.83%	14.82%	13.68%	13.45%
Abnormal Return (AROE)	2.004%	1.750%	1.997%	2.700%	2.052%	2.688%	2.076%	2.142%

Table 7. Raytheon, E-Systems Merger Results

4. Lockheed Martin Acquires Loral

Lockheed Martin (LMT) announced plans to acquire most of Loral Corp. (LOR) on 7 Jan 1996. LMT paid $7.6 billion for LOR's defense electronics and system integration businesses using the purchase method of accounting. Loral stockholders received $38 in cash per share plus shares on a 1:1 basis in a newly formed public company called Loral Space and Communications. LMT took a 20 percent equity position in the new company, which owned substantially all of Loral's former space and satellite communication business, and assumed $2.1 billion of LOR's debt. The merger was consummated on 29 April 1996 when Loral changed its name to LMT Tactical Systems and became a wholly owned subsidiary of LMT.

Loral designed and manufactured a variety of defense electronics systems. Total revenue in 1995 was $6.1 billion, with defense sales comprising 81.7 percent of that total. Primary product areas included: command, control, communications, and intelligence systems, reconnaissance, electronic warfare, systems integration, training and simulation, and tactical weapons. Loral made complete missiles as well as guidance and fire control systems for missiles. LOR made two notable acquisitions prior to merging with LMT. In March 1994, it acquired IBM's Federal Systems division for $1.57 billion in cash. The following year, LOR

acquired Unisys Corp.'s Defense Systems business, a leading systems integrator, for $862 million in cash.

By early 1996, LMT had restructured to absorb Martin Marietta. LMT acquired LOR, its first since Martin Marietta, to enhance its electronics, tactical systems, and information technology services. With LOR's and Martin Marietta's new business lines, LMT transformed itself from being primarily a supplier of aircraft and aircraft related systems to having more reliance on defense electronics.

LMT's 1996 annual report recorded total revenue of $26.8 billion with 53.4 percent in defense sales. LMT maintained its position as the number one defense contractor measured in value of total defense revenue. LMT's chairman, Daniel Tellep, said of the merger with Loral, "It enhances our technological base, improves our competitiveness, expands our global reach and provides new opportunities for growth" (Reuters, 1996).

Table 8 provides the variables used for the Lockheed Martin, Loral merger with the resulting AROE expressed in percentage terms.

Table 8. Lockheed Martin, Loral Merger Results

Abnormal Earnings Worksheet
Lockheed Martin Acquires Loral

	Premerger Period		Announcement		Interim Period		Post-Merger	
	LMT	Loral	LMT	Loral	LMT	Loral	LMT	
	5-Oct-95 to 5-Jan-96		8-Jan-96		9-Jan-96 to 29-Apr-96		30-Apr-96 to 30-Jun-96	1-Jul-96 to 31-Dec-96
EBO Variable								
Closing Stock Price (P)			$ 80.25	$ 44.50				
Period Stock Price (P_{ave})	$ 73.08	$ 32.06			$ 77.19	$ 47.26	$ 82.95	$ 87.80
Book Value/Share (Bv_{ave})	$ 26.61	$ 10.90	$ 27.28	$ 11.16	$ 28.06	$ 10.34	$ 29.36	$ 30.65
Historical Growth (1-k)	65%	79%	65%	79%	65%	79%	65%	65%
Cost of Capital (r)	10.71%	11.98%	10.71%	11.98%	10.36%	11.63%	10.42%	10.42%
P minus Bv	$ 46.47	$ 21.16	$ 52.97	$ 33.34	$ 49.13	$ 36.92	$ 53.59	$ 57.15
ROE	13.78%	13.91%	13.93%	14.22%	13.33%	13.91%	13.47%	13.49%
Abnormal Return (AROE)	3.066%	1.928%	3.218%	2.237%	2.969%	2.282%	3.046%	3.074%

5. Boeing Merges with McDonnell Douglas

On Sunday, 15 December 1996, Boeing (BA) announced its plan to merge with McDonnell Douglas (MD) in a stock deal worth $13.3 billion, the largest merger ever in the aerospace industry. MD stockholders received 1.3 shares of Boeing stock (split adjusted 2 for 1, June 97) for each MD share held. Boeing issued 279 million new shares of common stock to consummate the merger on 1 August 1997. (Note: Boeing also issued stock worth $3.025 billion to acquire Rockwell's Aerospace and Defense business in December 1996.)

McDonnell Douglas had a historically strong presence in military and commercial aircraft design and manufacture. Total revenue in 1996 was $13.8 billion; 73.2 percent to defense sales. MD's major defense aircraft programs included: AV-8B Harrier II, C-17 Globemaster, F-15, F-18, AH-64 Apache, and the T-45 training system. Their space and missiles sector provided Harpoon, Delta and Tomahawk missiles. MD's market share of commercial aircraft fell to only 4 percent in 1996 with orders for the MD-11, MD-80 and MD-90 dwindling. Before the merger was announced, DOD eliminated MD from the competition to build the Joint Strike Fighter. LMT and Boeing were the surviving contestants. (Bryant, 1996)

Boeing is predominately a commercial aircraft builder, but maintains significant defense programs. Total revenue in 1996 was $22.7 billion while defense sales accounted for

only 25.1 percent. Boeing's commercial airliners include the 737, 747, 757, 767, and 777. BA's major defense programs include: CH-47 helicopters, V-22, E-3 AWACS, F-22 (wings, fuselage, radar, avionics integration, and 70% of mission software), and systems for the B-2.

This merger made sense for Boeing for two reasons. First, they eliminated a competitor in commercial airliners while gaining excess capacity at the Douglas division's plants to build airliners that Boeing needed to keep up with airliner demand. Second, MD's existing programs and experience in military aircraft positioned Boeing as the only viable competitor to LMT.

BA's revenue for the nine months ending 30 September 1997 was $34.1 billion. Although rankings for 1997 are not tabulated, BA should rank second to LMT with between $12 - 15 billion in defense sales.

Table 9 provides the variables used for the Boeing, McDonnell Douglas merger with the resulting AROE expressed in percentage terms. Post-merger data was based on pro forma third quarter financial statements.

Abnormal Earnings Worksheet

Boeing merges with McDonnell Douglas

EBO Variable	Premerger Period		Announcement		Interim Period		Post-Merger
	Boeing	MD	Boeing	MD	Boeing	MD	Boeing
	15-Sep-96 to 15-Dec-96		16-Dec-96		17-Dec-96 to 1-Aug-97		4-Aug-97 to 30-Sep-97
Closing Stock Price (P)			$ 50.38	$ 62.50			
Period Stock Price (P_{ave})	$ 47.48	$ 52.36			$ 53.13	$ 65.37	$ 55.63
Book Value/Share (Bv_{ave})	$ 14.62	$ 13.82	$ 14.89	$ 14.31	$ 15.58	$ 15.42	$ 15.07
Historical Growth (1-k)	62%	50%	62%	50%	62%	50%	62%
Cost of Capital (r)	10.94%	10.86%	10.94%	10.86%	10.96%	10.88%	11.12%
P minus Bv	$ 32.86	$ 38.54	$ 35.49	$ 48.19	$ 37.55	$ 49.95	$ 40.56
ROE	14.80%	17.22%	14.90%	17.71%	14.95%	17.65%	15.34%
Abnormal Returns (AROE)	3.863%	6.363%	3.957%	6.857%	3.982%	6.527%	4.216%

Table 9. Boeing, McDonnell Douglas Merger Results

6. Raytheon Pending Merger with Hughes Defense

Raytheon (RTN) announced plans to acquire Hughes Electronics defense business on 15 January 1997. Hughes Electronics consists of defense, Delco Electronics and space operations. In a complicated transaction, RTN will pay about $9.5 billion in stock and cash to General Motors (GM) and Hughes (GM class H) stockholders for the defense part of the company. GM owns all of Hughes Electronics, but Hughes trades separately under the symbol GMH. RTN stockholders will receive Class B shares in the new Raytheon which will represent 70 percent of the company. GM common and GMH stockholders will receive Class A shares totaling 30 percent of the new Raytheon. This will be a tax free transaction for both firms and the stockholders. GM will transfer Hughes' Delco Electronics to its automotive systems business and will retain control of the telecommunications and space operations. The deal is expected to close in the third quarter of 1997.

Hughes Defense business contributed 40 percent to both GMH's sales and profits in 1996. The defense business alone had total 1996 revenue of $6.3 billion. GMH's defense product areas include: electro-optics (forward looking infrared radar, night vision equipment, laser range finders), missile systems, and ground based radar systems. Newer information system and service programs include:

Desktop V, Wide Area Augmentation System, and Hughes Air Warfare Center.

In 1997, RTN still operated in the same four businesses described from 1994. RTN's 1996 revenue totaled $12.3 billion with 32.8 percent attributed to defense sales. The company absorbed E-Systems defense electronics products from the 1995 merger and completed a $2.95 billion purchase of Texas Instruments defense business on 11 July 1997.

RTN has positioned itself as the third biggest defense contractor behind Lockheed Martin and Boeing. The firm will have total revenue of nearly $21 billion after the Hughes deal is closed with defense revenue of $13 billion. The defense electronics share of its business will increase to 60 percent of revenues from only 40 percent in 1994.(Lipin & Stern, 1997)

The Department of Justice (DOJ) approved RTN's proposed merger with Hughes on 2 October 1997, but with two stipulations. First, the DOJ prompted RTN to sell an infrared sensor and ground electro-optical systems business prior to the merger over concerns that the new firm would have near monopoly control in certain air-to-air missiles, night vision, sensors for satellites, and radar technologies (Mintz, 1997). The DOJ also set up a "firewall" so that RTN and GMH teams can still bid for an anti-tank missile system while keeping the technology separate within the company.

Table 10 provides the variables used for the Raytheon, Hughes merger (to date) with the resulting AROE expressed in percentage terms. Financial data for the Texas Instrument defense acquisition is not included in the these results.

Abnormal Earnings Worksheet

Raytheon's pending merger with Hughes Defense Business

EBO Variable	Premerger Period		Announcement		Interim Period	
	Raytheon	Hughes	Raytheon	Hughes	Raytheon	Hughes
	15-Oct-96 to 15-Jan-97		16-Jan-97		17-Jan-97 to 30-Sep-97	
Closing Stock Price (P)			$ 48.50	$ 62.68		
Period Stock Price (P_{ave})	$ 49.24	$ 55.75			$ 49.27	$ 59.06
Book Value/Share (Bv_{ave})	$ 19.27	$ 22.82	$ 19.58	$ 23.02	$ 20.39	$ 23.83
Historical Growth (1-k)	73%	54%	73%	54%	73%	54%
Cost of Capital (r)	11.01%	11.88%	11.01%	11.88%	11.01%	11.88%
P minus Bv	$ 29.97	$ 32.93	$ 28.92	$ 39.66	$ 28.88	$ 35.23
ROE	13.19%	16.36%	13.14%	16.81%	13.08%	16.41%
Abnormal Return (AROE)	2.175%	4.473%	2.123%	4.924%	2.078%	4.532%

Table 10. Raytheon, Hughes Merger Results

7. Lockheed Martin's Pending Merger with Northrop Grumman

Lockheed Martin (LMT) announced plans to merge with Northrop Grumman (NOC) after the market close on 3 July 1997. NOC stockholders will receive 1.1923 shares of LMT common stock for each share of NOC stock. The transaction is pending shareholder approval and DOJ review. LMT will use the pooling of interest method of accounting and expects to complete the deal in early 1998.

By mid 1997, NOC operated in four main segments including military and commercial aircraft, electronics and system integration, data systems, and missiles. Approximately 82.7 percent of NOC's $8.1 billion 1996 revenue was from defense sales. Major programs include: E-8 Joint Surveillance Target Attack Radar System (JSTARS), E-2C Hawkeye, and the BAT "brilliant" anti-armor munitions. It is a major subcontractor for the F-18 and provides aircraft components and subassemblies for the C-17 and commercial airliners. The B-2 program accounted for 19 percent of 1997's first quarter revenue verses 50 percent in 1993. NOC acquired Westinghouse Electric's defense and electronics systems business in March 1996 for $3.6 billion in cash. On 1 August 1997, NOC issued 8.6 million shares of common stock to complete the acquisition of Logicon, a leader in battle management and information technology.

LMT was the largest and most diversified defense contractor before adding NOC's product lines. Their revenue for the nine months ending 30 September 1997 was $20.2 billion and backlog orders totaled $46.9 billion. LMT's 1997 defense contracts include: AEGIS air defense systems, THAAD air defense system, Milstar satellites, F-16, F-22, C-130, P-3, and development of Space Based Infrared System, Airborne Laser, and the Joint Strike Fighter (JSF) in competition with Boeing. The winner of the JSF program could take home a revenue stream of $750 billion over the production life of the aircraft (Bryant, 1996).

The combined company will have total revenue of about $37 billion in 1997. Sales to the U.S. government should continue to account for 60 to 70 percent of total revenue (Liu, 1997). This merger will position LMT to either be the prime contractor for the JSF program or a major subcontractor for its avionics package using Northrop's product lines.

Table 11 provides the variables used for the Lockheed Martin, Northrop Grumman merger (to date) with the resulting AROE expressed in percentage terms. Average Book Values were calculated using pro forma third quarter financial statements.

Table 11. Lockheed Martin, Northrop Grumman Merger Results

Abnormal Earnings Worksheet

Lockheed Martin's pending merger with Northrop Grumman

	Premerger Period		Announcement		Interim Period	
	LMT	NOC	LMT	NOC	LMT	NOC
	7-Apr-97 to 7-Jul-97		7-Jul-97		8-Jul-97 to 30-Sep-97	
EBO Variable						
Closing Stock Price (P)			$ 93.13	$ 111.00		
Period Stock Price (P_{ave})	$ 91.63	$ 82.02			$ 104.70	$ 117.06
Book Value/Share (Bv_{ave})	$ 32.18	$ 38.33	$ 32.71	$ 39.10	$ 33.54	$ 40.09
Historical Growth (1-k)	65%	65%	65%	65%	65%	65%
Cost of Capital (r)	10.42%	11.55%	10.42%	11.55%	10.41%	11.54%
P minus Bv	$ 59.45	$ 43.69	$ 60.42	$ 71.90	$ 71.16	$ 76.97
ROE	13.48%	14.19%	13.48%	14.93%	13.66%	14.99%
Abnormal Return (AROE)	3.060%	2.646%	3.060%	3.385%	3.249%	3.449%

C. DATA ANALYSIS

This section analyzes the resulting abnormal returns from the sample firms in all seven mergers. The analysis uses quantitative results from the transformed EBO model to assess the impact of these mergers based on the changes in AROE. Observations and interpretations of the changes in abnormal returns between the five measured stages in the merger process are discussed and conclusions are drawn. Individual firm AROE values are also used for direct comparison and analysis. Finally, observations concerning the EBO model's utility for differentiating abnormal earnings from stock prices are explained.

General patterns are identified where evident. Additionally, change in AROE is explained in terms of being a function of several independent factors. These factors are used to isolate patterns in the data for interpretation. Not all factors are identified or discussed at each period. The factors are listed below:

- Role of the participant (acquirer or acquiree)
- Form of merger transaction
  - -Exchange of stock
  - -Exchange of cash
- Size in terms of dollar value
  - - Of the merger
  - - Of the firms involved in the merger (Annual Sales)
- Line of Business (LOB) (Aircraft vs. Defense Electronics)
- Trend (tendency for AROE to change systematically over time)

Line of Business (LOB) and size comparisons for each firm are based on information presented earlier in this chapter.

The resulting abnormal returns from each stage in the merger process are summarized for all firms in Table 12. The left side of the table lists the sample mergers in chronological order numbered from one to seven. The analysis refers to each merger by its number. The timeline below each merger refers to the start of the premerger period through the last day of the last stage analyzed. The bold boxes in the columns contain the AROE's for each merger stage from each firm's Abnormal Earnings Worksheet. The shaded columns, beside each "boxed" AROE, contains the percentage change between the adjacent stages. Reading from top to bottom shows AROE for any given stage in chronological order for the separate mergers. Reading from left to right shows individual firm AROE as the merger process moves through each stage.

Table 12. Consolidated Results of Abnormal Returns

	Merger	Premerger AROE	Percent Change 1	Announcement AROE (Immediate)	Percent Change 2	Interim AROE "Fully Digested"	Percent Change 3		Post Merger AROE Period 1 Immediate	Post Merger AROE Period 2 "Digested"	Percent Change 4	Percent hange 5
	Northrop Corp. (NOC)	1.510%	-10.60%	1.350%	1.48%	1.370%	-9.27%					
1)	Value: $2.1B (Cash)							Northrop Grumman (NOC)	0.980%	1.610%	-28.47%	64.29%
	Grumman Corp. (GQ)	1.970%	100.51%	3.950%	-1.27%	3.900%	97.97%					
		Dec 1993	→							Dec 1994		
	Lockheed Corp. (LK)	1.308%	38.07%	1.806%	5.37%	1.903%	45.49%					
2)	Value: $9B (Stock)							Lockheed Martin (LMT)	2.440%	2.847%	28.22%	16.68%
	Martin Marietta (ML)	1.351%	3.03%	1.392%	33.84%	1.863%	37.90%					
		May 1994	→							Dec 1995		
	Raytheon (RTN)	2.004%	-0.35%	1.997%	1.60%	2.029%	1.25%					
3)	Value: $2.3B (Cash)							Raytheon (RTN)	2.076%	2.142%	2.32%	3.18%
	E-Systems (ESY)	1.750%	54.29%	2.700%	-0.44%	2.688%	53.60%					
		Jan 1995	→							Dec 1995		
	Lockheed Martin (LMT)	3.066%	4.96%	3.218%	-7.74%	2.969%	-3.16%					
4)	Value: $7.6B (Cash)							Lockheed Martin (LMT)	3.046%	3.074%	2.59%	0.92%
	Loral (old) (LOR)	1.928%	16.03%	2.237%	2.01%	2.282%	18.36%					
		Oct 1995	→							Dec 1996		
	Boeing (BA)	3.863%	2.43%	3.957%	0.63%	3.982%	3.08%					
5)	Value: $13.3B (Stock)							Boeing Company (BA)	4.216%		5.88%	
	McDonnell Douglas (MD)	6.363%	7.76%	6.857%	-4.81%	6.527%	2.58%					
		Sept 1996	→							Sept 1997		
	Raytheon (RTN)	2.175%	-2.39%	2.123%	-2.12%	2.078%	-4.46%					
6)	Value: $9.5B (Cash)											
	Hughes Electronics (GMH)	4.473%	10.08%	4.924%	-7.96%	4.532%	1.32%					
		Oct 1996	→			Sept 1997						
	Lockheed Martin (LMT)	3.060%	0.00%	3.060%	6.18%	3.249%	6.18%					
7)	Value: $11.6B (Stock)											
	Northrop Grumman (NOC)	2.646%	27.93%	3.385%	1.89%	3.449%	30.35%					
		April 1997	→			Sept 1997						

1. Premerger to Announcement

This period compares the premerger "clean" AROE the firm was expected to earn before the merger to the AROE calculated on the announcement date. This measure reflects investors' "immediate" reactions to the merger and reflects initial revisions to their expectations concerning future returns. The first shaded column on Table 12 shows the difference between these stages as "percent change 1".

a. General Patterns

There was a vague "reciprocal" relationship concerning the magnitude of changes in AROE between the two participants in all mergers. Mergers where one participant exhibited a large positive change tended to include another participant which exhibited a negative change. For example, in merger (1), Grumman's AROE increased by 100.51%, the largest positive change. Northrop's AROE decreased the by -10.60%, the largest negative change. This divergence between participants is the result of the market expecting a large increase in earnings potential attributable to one firm and not the other. The market's immediate reaction is to expect the acquiring firm's future earnings to be negatively affected by the higher premium the firm pays for the acquiree.

b. Role

All acquired firms' AROE increased, ranging from 100.51% for Grumman to 3.03% for Martin Marietta. In these

cases, the acquirer believes that it can earn superior returns with the acquiree's assets than the firm is currently producing. Therefore, the acquiring firm values the acquiree above its current market price (a premium).

Three of the seven acquiring firms' AROE decreased (Mergers 1, 3, 6). The acquiring firm's AROE decreases/increases because investors lower/raise their estimates of the firm's future earning power due to the merger. Decreasing AROE is consistent with lack of confirmation by investors that mergers will necessarily increase earnings power of the acquiring firms.

c. Form

The three acquirers showing the decreases in AROE used cash transactions (Mergers 1, 3, 6). In a cash transaction, the acquiring firm pays cash to buy outstanding shares of the acquiree. This often requires that the acquiring firm increase its long term debt or use existing cash on hand or both. Investor response is to reduce their assessments of the acquiring firm's abnormal return due to their expectation of increased risk resulting from the merger.

The AROE of all three acquirers using stock transactions increased or remained constant (Mergers 2, 5, 7). In a stock transaction, the acquiring firm issues new shares in exchange for shares of the acquiree. The firm incurs no new long term debt, but must float a larger amount

of shares on the market. Investor assessment is that issuing stock is more beneficial to earnings than using debt to acquire new assets. In merger (2), Lockheed's AROE increased at the merger announcement by 38.07 percent. The market interpreted that Lockheed's merger with Martin Marietta would increase the firm's ability to earn abnormal returns in the future.

d. Size

The AROE's of the two smallest firms increased the most; Grumman $3.2 billion sales, and E-Systems $2 billion sales (Mergers 1, 3). Smaller firms most likely command a higher "premium" from the acquiring firm. Their small size allows the acquiring firm to quickly employ their new resources without much restructuring. These mergers were also cash transactions.

e. Conclusions

A firm's AROE change at the announcement stage is due to the merger. Acquired firms of smaller size tend to have the greatest increase in AROE. The magnitude of the change in other firms is unpredictable. The direction of change in AROE is a function of the role of the participant and the form of the merger transaction.

2. Announcement to Consummation

This period compares the announcement date AROE to the Interim period AROE. This measure illustrates any adjustment of AROE by investors as a result of more detailed

information or analysis concerning the merger's impact on future abnormal returns. The second shaded column on Table 12 shows the difference between these stages as "percent change 2".

a. General Patterns

Thirteen of 14 firms saw only minor changes in AROE of between 6.18 percent to negative 7.96 percent. The overall changes in AROE between these periods represents a delayed effect of the merger announcement to the market, but the delayed effect is small. Initial expectations for future returns were fairly accurate since further analysis or information did not significantly change the assessment.

Martin Marietta's AROE increased significantly more than any firm between these stages (33.84%) (Merger 2). Lockheed and Martin Marietta's interim period was seven months long giving investors time to digest the information concerning the merger. The initial assessment of Lockheed's ability to earn abnormal returns with Martin Marietta was too low at the announcement date.

b. LOB

AROE's for defense electronics firms, Raytheon and Hughes, were both adjusted downward during the digestive period (Merger 6). This represented the only occasion where both participant's AROE declined concurrently. The market was uncertain as to what action the Department of Justice would take concerning Raytheon's and Hughes's dominance in

guided missile technology. This uncertainty led to the downward revision in AROE for both firms.

c. Conclusions

Immediate reactions to the merger announcements are not always correct. This digestive or delayed effect is the market's way of moving toward a more accurate expectation of future earnings. The digestive effect was small compared to changes seen in other periods.

3. Premerger to Consummation

This period skips the announcement date result which is due to the merger and focuses on a longer term expectation of investors. It compares the "clean" AROE result with the last measured AROE for each firm prior to the merger consummation. This measure represents investor's initial assessment plus the adjustments for subsequent analysis of the information which yields the "fully digested" expectations concerning future returns. The third shaded column on Table 12 shows the difference between these stages as "percent change 3".

a. General Patterns

In merger (2), both Lockheed's and Martin Marietta's AROE increased significantly. There was no "reciprocal" effect. Expectations adjusted to reflect that Lockheed could earn a better return on its own assets by merging with Martin Marietta, and earn a better return than

Martin Marietta currently was. This may be an example of expectations of future synergistic effects for this merger.

b. Role

All acquired firms' AROE increased. The interpretation here is consistent with that of the premerger to announcement date analysis.

Three of the seven acquiring firms' AROE decreased (Mergers 1, 4, 6). This interpretation is the same as the premerger to announcement date analysis except that Lockheed Martin (Merger 4) replaces Raytheon (Merger 3).

c. Form

The three acquirers showing decreases in AROE used cash transactions (Mergers 1, 4, 6). The expectation for future abnormal returns is revised, but still negative. New information or analysis did not change direction from the initial expectation for cash transactions in general.

The AROE for all three acquirers using stock transactions increased (Mergers 1, 5, 7). The interpretation here is consistent with that of the premerger to announcement date analysis.

d. Trend

Mergers (5) and (6) show little change in AROE for any of the four firms. Boeing, McDonnell Douglas, Raytheon, and Hughes showed very little variation in AROE throughout their merger processes. This indicates that expectations for their future abnormal earnings due to the merger is not much

greater than if the firms had not made plans to merge at all.

e. Conclusions

The change in the firm's AROE at the interim stage is due to the merger and fully digesting current information concerning the merger. The resulting, "Fully Digested" AROE is more meaningful than the AROE at the announcement date.

The adjustments to expectations of future returns, while occurring for every firm, did not materially change from the patterns encountered at the announcement date. Acquirees tend to exhibit increases in their AROE due to the merger. Acquirers using stock transactions also tend to exhibit increases in their AROE.

4. Interim Period to Post-Merger Period 1

This comparison captures the difference between the acquiring firm's "fully digested" AROE and the AROE of the newly merged firm. This measure reflects the investors "immediate" reactions to the newly merged firm and initial revisions to expectations concerning future returns as a result of consummating the merger.

Only five of the seven mergers could be analyzed at this stage, since two have yet to be consummated. The forth shaded column on Table 12 shows the difference between these stages as "percent change 4".

a. General Patterns

The new firm's AROE increased in four of five mergers (Mergers 2, 3, 4, 5). The new firm's AROE is a consolidated expectation of future returns from both the acquiree and acquirer. The increases in AROE reflect the expectation of additional future abnormal earnings the now merged acquiree will contribute to the new firm.

Northrop Grumman's AROE was 28.47 percent lower than Northrop's "fully digested" AROE (Merger 1). Northrop financed its cash purchase of Grumman almost entirely from new debt. While Northrop may have anticipated the ability to earn higher abnormal returns by acquiring Grumman, market expectations immediately after the merger reflected lower future rates of return.

b. Form

Raytheon and Lockheed Martin posted increased AROE using a cash transaction (Mergers 3, 4), while Lockheed Martin and Boeing posted increased AROE using a stock transaction (Mergers 2, 5). By this time in the merger process, the effects of the form of the merger was already anticipated in the expectation of future earnings for the firm.

c. Conclusion

This stage shows that four out of five firms increased their abnormal rate of return through merger activity. However, this result is the market's immediate

expectation of the new firm's future abnormal earnings generating capability based on limited information concerning the actual effects of the merger consummation.

5. Post-Merger Period 1 to Post-Merger Period 2

This period's change addresses only the post-merger firm. It assesses the change in AROE from Post-merger Period 1 to Period 2. This measure reflects investors reassessment of AROE given more information or analysis of the merger's actual effect on the new firm. It isolates the ability of the new firm to absorb the assets, personnel and operations of the acquiree, the "digestive effects", between the two periods. The fifth shaded column on Table 12 shows the difference between these stages as "percent change 5".

a. General patterns

Each merged firm's AROE increased between these stages (Mergers 1-4). The time lag between these stages allows the new firm to restructure and bring the acquired firm into the folds of the new organization. The resulting AROE data shows that each firm strengthened its abnormal earnings power during the period. The increase in AROE could be due to other factors including increased efficiencies or synergy created by the merger.

b. Form

There was no difference between stock or cash transactions (Mergers 1-4). The effects of the stock or

cash transaction has been fully realized by the new firm and digested by investors.

c. Trend

The earliest mergers, Northrop Grumman and Lockheed Martin, had the largest increases in AROE (Mergers 1, 2). The market's expectations of future abnormal returns was adjusted higher due to new information concerning the new firms' growth prospects. The reassessment also may have been based on restructuring efforts, efficiency gains, or synergy.

The rate of increase in AROE is decreasing over time (Mergers 1-4). The first mergers in the sample created some positive benefits for the firms as expectations for future earnings were high for the newly merged firm, as reflected in increases in AROE. As time passed, expectations were less enthusiastic for later mergers. Raytheon's AROE increased only 3.18% after acquiring E-Systems in 1995 (Merger 3). Lockheed Martin also saw a minuscule increase of .92% in AROE after its merger with Loral in 1996 (Merger 4).

d. Conclusions

Merger activity has had a positive impact on firms ability to earn abnormal returns in the short run. The enthusiasm for defense mergers, while still positive, is weakening over time. Investor expectation of future earnings for defense firms may have already peaked or reached a

plateau by 1997, indicated by a slower rate of growth in abnormal returns in most recent mergers.

6. Direct Comparison of AROE Values

The analysis in the first part of the chapter dealt only with isolated changes between stages in the merger process. While each post-merger firm had a higher rate of abnormal earnings after the merger process, several firms in the sample were involved in multiple mergers that provide additional observations of AROE.

a. General Observation

Boeing earns the highest abnormal rate of return (4.216%) compared to other firms in the sample. Therefore, Boeing could be considered the most effective in terms of monopoly power. However, Boeing's percentage of military sales are less significant than its peers. Boeing's higher rate may be due to its dominant position in the commercial airliner business.

b. Size

There is a relationship between the level of AROE values for all firms and the relative size of firms generating that AROE. The level of AROE values for all firms ranged from 1.37% - 3.9% in 1994-1995 (Mergers 1,2,3) to 2.078% - 6.527% in 1996-1997 (Mergers 4,5,6,7).

As of 30 Sept. 1997, the cutoff date for this analysis, five of the original twelve firms remained, with two mergers still uncompleted. The eight firms analyzed between 1994 to

1995 (Mergers 1,2,3, including post-merger firm) had sales between $2.0 billion and $22.8 billion. Firms in mergers (4, 5, 6, 7) Lockheed Martin, Raytheon, Boeing, and McDonnell Douglas had sales between $12.3 billion and $26.8 billion in 1996. The level of AROE percentage was generally higher for the remaining group of five firms with higher total revenues than when more firms were competing as in 1994.

c. LOB

The cumulative effect over several years of merger activity suggests that the change in measured AROE is significant for both Northrop Grumman (NOC) and Lockheed Martin (LMT). The primary line of business for both firms is aircraft manufacturing. NOC's AROE increased by 64 percent from Dec. 1994 (1.610%), to its premerger AROE in Apr. 1997 (2.646%) (Mergers 1, 7). During this period, NOC was involved in other mergers with Westinghouse Electric's defense and electronics systems and Logicon Corp. Lockheed Corp.'s (later Lockheed Martin) AROE increased by 148 percent from the premerger 1994 level (1.308%) to Sept. 1997 (3.249%) (Mergers 2, 7). Lockheed Corp. merged with Martin Marietta, Loral, and was proceeding with plans to merge with NOC during this period. In contrast, Raytheon's AROE only increased by 3.69 percent from Jan 1995 (2.004%) to 30 Sept. 1997 (2.078%) (Mergers 3, 6). Raytheon's primary line of business is defense electronics.

d. Conclusions

As defense firms became larger, resulting from merger activity, levels of abnormal returns increased. Aircraft manufacturers, LMT, BA, and NOC were rewarded with higher expectations of abnormal earnings than the defense electronics firm Raytheon.

D. OBSERVATIONS CONCERNING THE EBO METHODOLOGY

Change in AROE is not equivalent to the change in price. Price valuations are tied to book value, cost of capital, growth, and expectations concerning AROE, as related in the EBO model. If price and AROE were equivalent, this research would only need to analyze the change in price during the merger process. Since prices instead reflect a number of factors, removing the effects of these factors is required to provide a specific measure of AROE. From this measure, direct conclusions about expected future returns can be drawn.

Several examples of price and the measure of AROE moving in opposite directions exist in the data, reinforcing the idea that price and AROE are not equivalent measures. For example, in merger (7), Lockheed Martin's (LMT) resulting AROE did not change between these stages for their 1997 merger announcement with Northrop Grumman, yet LMT's price did increase. The reason was that Lockheed Martin's book value had increased as well. If change in AROE was

equivalent to change in price that would imply that assessments of AROE had changed, which was not the case.

In merger (2), Martin Marietta's higher AROE during the interim period did not change as stock price changed. In fact, ML's average stock price was lower during the interim period than on the announcement date (see Table 6). The decrease in stock price can be attributed to a higher cost of capital as interest rates rose by 1.5 percentage points during the seven months between stages of this merger. Thus, direct observation of the change in stock price does not indicate the expectations concerning AROE.

E. SUMMARY

This chapter presented the resulting AROE for each firm along with descriptions of each merger process. The effects of merger activity was analyzed in terms of changes in AROE across all merger stages. Observations relating to the usefulness of the transformed EBO model for the analysis were also discussed.

Chapter VI summarizes the conclusions drawn from the analysis, provides answers to the research questions and recommends areas for further research.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

This research set out to examine whether merger activity in the defense industry has created monopoly power in individual defense firms. Monopoly power was defined as a firm's ability to generate abnormal earnings. The EBO model provided a means to measure expected abnormal earnings of a firm using accounting and non-accounting data. The results of the pre and post-merger analysis are summarized below:

- All post-merger firms analyzed recorded higher Abnormal Rates of Return on Equity (AROE) than before the merger.
- As firms increased in size, and fewer competitors existed due to merger activity, the level of AROE increased.
- The most recent post-merger results showed smaller increases in AROE from their premerger levels.
- The magnitude of the change in AROE due to the merger was unpredictable.
- The announcement of a merger caused the market to reassess the expected future returns for the two participants in some systematic ways.
  - All acquirees experienced increases in expected AROE.
  - The acquirer's AROE generally increased when using a stock transaction.
  - The acquirer's AROE generally decreased when using a cash transaction.

B. CRITIQUE OF EBO METHODOLOGY

The original EBO model was designed to estimate a firm's intrinsic value (theoretical price) as a function of future earnings, current book value growth and cost of

capital. The transformed version used in the research provided a forecast for future expected abnormal earnings. The resulting AROE measures demonstrate that changes in stock price alone are not equivalent to the changes in AROE, but are dependent on other factors including: a firm's book value, cost of capital and growth rate. In that regard, the model provided a measure not solely based on change in stock price to analyze the effects of mergers.

The transformed EBO model used actual stock prices as firm value and provided the market's expectation of abnormal earnings. The fundamental assumption germane to the analysis is that the stock market is efficient. This means that due to the collective action of investors seeking to use available information to their advantage, all information is rapidly reflected in current stock prices and hence, current prices are an unbiased measure of value. Since value is based on the ability of a firm to generate future earnings, the current market price can be used to reliably suggest what the future may be, including expectations for abnormal earnings. The abnormal rate of return is a measure of what an efficient market interprets the firm's abnormal earnings will be in the future.

Efficient markets are not omnicient; they do not predict the future with certainty. Nevertheless, they do render the most accurate assessment of what the future is expected to be, given available information. Actual outcomes

may not meet expectations, but the market is efficient enough to render a meaningful measure of abnormal earnings for this analysis.

The model assumed that defense firms' abnormal earnings would exist indefinitely. Since it is difficult for firms to enter the industry and, through competition, force abnormal earnings to zero, this is not an unreasonable assumption. However, the transformed EBO model does require some assumption concerning the period of abnormal earnings. The assumption adopted does bias all AROE measures downward.

C. CONCLUSIONS

The analysis showed that expected Abnormal Rates of Return on Equity (AROE) in all post-merger firms increased due to merger activity. If one accepts the notion that abnormal returns are an indicator of monopoly power, then these defense firms have increased their monopoly power through the merger activities analyzed.

Monopoly power is a question of degree. There exists no one level or threshold that a value of AROE must cross that would signal monopoly power. Rather, changes in AROE indicate a movement along a continuum of earnings power, between pure competition and pure monopoly. Pure competition and pure monopoly markets exist on opposite ends of the continuum. A firm in a purely competitive market will earn zero abnormal earnings while a pure monopoly firm will earn

some positive, though undefined, level of abnormal earnings. Thus, as a firm's AROE moves in a positive direction, its earnings power and monopoly position are increasing.

According to merger theory, one of the reasons firms merge is to achieve higher profitability. The research demonstrated that defense firms have enhanced their ability to generate abnormal earnings implied by higher levels of post-merger AROE. However, abnormal earnings could be generated for different reasons. Just because AROE is increasing does not mean a firm is pricing goods above a competitive price level. AROE could increase due to a firm increasing price while their costs remain constant. Such an ability to increase prices is consistent with monopoly power, but the firm's AROE could also increase due to charging the same price while lowering its costs. Efficiency gains and synergistic effects are two results of merger activity that tend to lower costs for a firm, but which are not necessarily evidence of monopoly power.

The research concludes that while no defense firm today is a true monopoly, the reduction of competition among defense firms from 1994 to 1997 has been accompanied by the ability of the largest firms to earn higher AROE. Merger activity among the three largest defense firms, Lockheed Martin, Boeing, and Raytheon, has created a firm structure defined as an oligopoly.

D. RECOMMENDATIONS FOR FUTURE RESEARCH

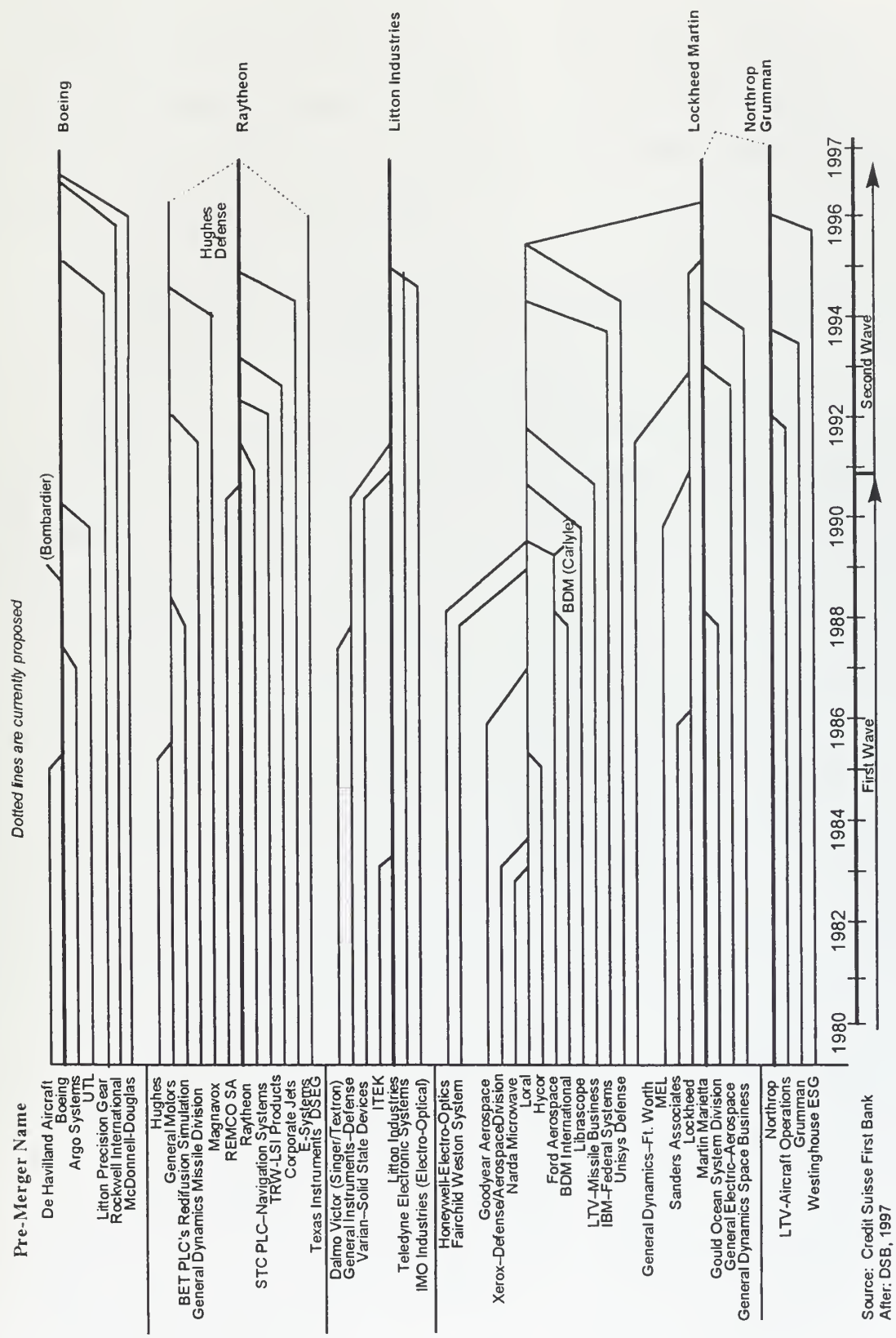
Valuation of defense firms: This research transformed the EBO model for alternative use. A future study may use the EBO model in the traditional way to estimate firm value. This may provide an interesting extension to this research if applied to defense merger activity.

Industry concentration and abnormal earnings: Is there a correlation between concentration ratio in an industry and abnormal earnings of firms in that industry? Shepherd (1997) proposed that there should be at least five comparable firms in a market for effective competition. After Lockheed Martin merges with Northrop Grumman and Raytheon merges with Hughes, there will be three major suppliers, including Boeing, that dwarf the next tier of defense firms. Together, these three firms will generate defense sales that account for between 50 and 60 percent of the total 1997 Defense Procurement and Research, Development, Testing and Evaluation (RDT&E) budget.

The impact of defense industry consolidation on research and development: Economists argue over whether a competitive industry is more likely to generate new ideas and foster innovation than an oligopoly or monopoly. In light if DOD's strategy to rely on advance technology as a means to remain a dominant military power, how has defense industry consolidation affected internal research and development efforts in firms?

Sources of financial information: The Naval Postgraduate School does not maintain adequate financial reference publications for research of this type. The researcher investigated many electronic sources to gather financial information from the Internet and Lexus/Nexus. A useful thesis for research may be, "A comprehensive guide to finding historical financial information of publicly traded companies."

APPENDIX A. DEFENSE INDUSTRY CONSOLIDATION TIMELINE



APPENDIX B. DATA TABLES

This appendix provides the raw data required to calculate abnormal rates of return for the individual firms pre and post-merger using the transformed EBO model. Data is listed in the following order:

- Three month T-bill rates
- Composite risk premium and SIC code description
- Historical Growth rates
- Company data tables for mergers 1 - 7.

Company data tables state accounting values for the firm as of their annual or quarterly report date. Stock prices are given in a high/low range for the particular reporting period.

Treasury Yield History		(Source: First Call Corp. & U.S. Treasury)	
Date	Ave Yield	Date	Ave Yield
9/29/97	4.967%	4/27/95	5.848%
8/29/97	5.210%	3/31/95	5.913%
7/31/97	5.220%	2/28/95	5.953%
6/30/97	5.250%	1/31/95	5.972%
5/30/97	4.940%	12/31/94	5.850%
4/30/97	5.230%	11/30/94	5.493%
3/31/97	5.310%	10/31/94	5.411%
2/28/97	5.210%	9/30/94	4.770%
1/31/97	5.130%	8/31/94	4.636%
12/31/96	5.190%	7/31/94	4.498%
11/29/96	5.110%	6/30/94	4.275%
10/31/96	5.130%	5/31/94	4.304%
9/30/96	5.030%	4/30/94	3.828%
8/30/96	5.280%	3/31/94	3.633%
7/31/96	5.300%	2/28/94	3.388%
6/28/96	5.150%	1/31/94	3.078%
5/31/96	5.170%	12/31/93	3.135%
4/30/96	5.120%	11/30/93	3.190%
3/29/96	5.110%	10/31/93	3.098%
2/29/96	5.010%	9/30/93	3.000%
1/31/96	5.040%	8/30/93	3.110%
12/31/95	5.318%	7/31/93	3.118%
11/30/95	5.525%	6/30/93	3.158%
10/31/95	5.456%	5/31/93	3.180%
9/30/95	5.410%	4/30/93	2.938%
8/31/95	5.568%	3/31/93	3.320%
7/31/95	5.630%	2/28/93	3.130%
6/30/95	5.633%	1/31/93	3.125%
5/30/95	5.686%		

SIC Codes and Cost of Capital Risk Premium

Source: Risk premium based on CAPM values found in Lee Article in Forbes

Company	S.I.C. Codes	Percent of Sales	SIC Risk Premium	Wt. Ave.	Composite Risk Premium
Northrop Corp.	3721	80%	0.0614	4.9%	**6.147%**
1993	3821	12%	0.0681	0.8%	
	3761	6%	0.0489	0.3%	
	7370	2%	0.0622	0.1%	
Grumman Corp.	3721	54%	0.0614	3.3%	**6.609%**
1993	7300	18%	0.0622	1.1%	
	3812	18%	0.0681	1.2%	
	3713	10%	0.0948	0.9%	
Northrop Grumman	3721/24/28	62%	0.0614	3.8%	**6.321%**
1994	3812	30%	0.0681	2.0%	
	7370	6%	0.0622	0.4%	
	3761	2%	0.0489	0.1%	
Northrop Grumman	3721	46%	0.0614	2.8%	**6.406%**
1997	3812	42%	0.0681	2.9%	
	7370	10%	0.0622	0.6%	
	3761	2%	0.0489	0.1%	
Martin Marietta	3812	41%	0.0681	2.8%	**5.742%**
1994	3761	36%	0.0489	1.8%	
	7370	18%	0.0420	0.8%	
	1499	5%	0.0866	0.4%	
Lockheed Corp.	3728	46%	0.0614	2.8%	**5.600%**
1994	3764	32%	0.0489	1.6%	
	7370	11%	0.0420	0.5%	
	3812	11%	0.0681	0.7%	
Lockheed Martin	3761/64	29%	0.0489	1.4%	**5.277%**
1995/96	3812	18%	0.0681	1.2%	
	3728	21%	0.0614	1.3%	
	7371/73	32%	0.0420	1.3%	
Loral (old)	3812	90%	0.0681	6.1%	**6.549%**
1995	7300	10%	0.0420	0.4%	

Company	S.I.C. Codes	Percent of Sales	SIC Risk Premium	Wt. Ave.	Composite Risk Premium
E-Systems	3812	60%	0.0681	4.1%	**6.232%**
1994	7373	16%	0.0420	0.7%	
	3728	6%	0.0614	0.4%	
	3721	18%	0.0614	1.1%	
Raytheon	3812	40%	0.0681	2.7%	**5.746%**
1993/94	3663	28%	0.0489	1.4%	
	3712	17%	0.0614	1.0%	
	3631/32	15%	0.0406	0.6%	
Raytheon	3812	46%	0.0681	3.1%	**5.878%**
1995/96	3663	24%	0.0489	1.2%	
	3712	17%	0.0614	1.0%	
	3631/32	13%	0.0406	0.5%	
Raytheon	3812	44%	0.0681	3.0%	**5.873%**
1996/97	3663	25%	0.0489	1.2%	
	3712	19%	0.0614	1.2%	
	3631/32	12%	0.0406	0.5%	
Hughes	5065	35%	0.0619	2.2%	**6.744%**
1996/97	3694	31%	0.0948	2.9%	
	4899	34%	0.0482	1.6%	
Boeing	3721	76%	0.0614	4.7%	**5.826%**
1995/96	3761	22%	0.0489	1.1%	
	7373	2%	0.0420	0.1%	
McDonnell Douglas	3721/24	83%	0.0614	5.1%	**6.102%**
1996	3761	7%	0.0489	0.3%	
	3812	7%	0.0681	0.5%	
	7359	3%	0.0622	0.2%	
The Boeing Co.	3721/24	80%	0.0614	4.9%	**5.990%**
1997	3761	14%	0.0489	0.7%	
	3812	3.5%	0.0681	0.2%	
	7370	2.5%	0.0622	0.2%	

STANDARD INDUSTRIAL CODE (SIC) NUMBERS AND DESCRIPTION

1499	**Miscellaneous Non Metallic Minerals**	
36	**Electrical Equipment**	
	3631/32	Major Appliances
	3663	Radio, TV, Communications Equipment
	3694	Engine Electrical Equipment
37	**Transportation Equipment**	
	3713	Truck, Bus Bodies
	3721	Aircraft
	2724	Aircraft Engines, Engine Parts
	3728	Aircraft Parts, Equipment
	3761/64	Space Vehicles, Missiles
38	**Instruments and Related Products**	
	3812	Search, Navigation Equipment
4899	**Communication Services**	
50	**Wholesale Trade**	
	5065	Electrical Parts, Equipment
73	**Miscellaneous Business Services**	
	7370	Computer Related Services
	7371	Custom Computer Programming Services
	7373	Computer Integrated Systems Design
	7359	Equipment Rental, Leasing

Annual: Earnings, Dividends, Payout Ratios, Retention Rates								
Northrop Grumman Corp. (NOC)	**Growth Rate**	**1996**	**1995**	**1994**	**1993**	**1992**	**1991**	**1990**
Earnings per share		$ 3.99	$ 5.11	$ 5.00				
Dividend per share		$ 1.60	$ 1.60	$ 1.60				
Payout Ratio		0.401	0.313	0.320				
Retention Rate	0.655	0.599	0.687	0.680				
Northrop Corp. (NOC)								
Earnings per share					$ 1.99	$ 2.56	$ 4.26	$ 4.48
Dividend per share					$ 1.60	$ 1.20	$ 1.20	$ 1.20
Payout Ratio					0.804	0.469	0.282	0.268
Retention Rate	0.544				0.196	0.531	0.718	0.732
Grumman Corp. (GQ)								
Earnings per share					$ 1.90	$ (3.49)	$ 2.84	$ 2.46
Dividend per share					$ 1.15	$ 1.00	$ 1.00	$ 1.00
Payout Ratio					0.605	(0.287)	0.352	0.407
Retention Rate	0.545				0.395	1.287	0.648	0.593
Lockheed Martin (LMT)	**Growth Rate**	**1996**	**1995**	**1994**	**1993**	**1992**	**1991**	**1990**
Earnings per share		$ 6.04	$ 3.05					
Dividend per share		$ 1.60	$ 1.34					
Payout Ratio		0.265	0.439					
Retention Rate	0.648	0.735	0.561					
Lockheed (LK)								
Earnings per share				$ 7.00	$ 6.70	$ 5.65	$ 4.86	$ 5.30
Dividend per share				$ 2.24	$ 2.12	$ 2.09	$ 1.95	$ 1.80
Payout Ratio				0.320	0.316	0.370	0.401	0.340
Retention Rate	0.651			0.680	0.684	0.630	0.599	0.660
Martin Marietta (ML)								
Earnings per share				$ 5.05	$ 3.80	$ 3.61	$ 3.15	$ 3.26
Dividend per share				$ 0.93	$ 0.87	$ 0.80	$ 0.75	$ 0.69
Payout Ratio				0.184	0.229	0.220	0.238	0.213
Retention Rate	0.783			0.816	0.771	0.780	0.762	0.787
Loral (old) (LOR)								
Earnings per share		$ 2.10	$ 3.38	$ 2.72	$ 2.07	$ 2.00	$ 1.78	$ 1.71
Dividend per share		$ 0.24	$ 0.59	$ 0.55	$ 0.50	$ 0.47	$ 0.43	$ 0.42
Payout Ratio		0.112	0.175	0.200	0.239	0.235	0.242	0.246
Retention Rate	0.793	0.888	0.825	0.800	0.761	0.765	0.758	0.754
Raytheon (RTN)	**Growth Rate**	**1996**	**1995**	**1994**	**1993**	**1992**	**1991**	**1990**
Earnings per share (not adjusted for 95 split)		$ 3.30	$ 3.25	$ 4.51	$ 5.11	$ 4.72	$ 4.48	$ 4.27
Dividend per share		$ 0.79	$ 0.75	$ 1.46	$ 1.40	$ 1.33	$ 1.20	$ 1.18
Payout Ratio		0.239	0.231	0.324	0.274	0.282	0.268	0.276
Retention Rate	0.729	0.761	0.769	0.676	0.726	0.718	0.732	0.724
E-Systems (ESY)				$ 2.79	$ 3.58	$ 3.31	$ 3.35	$ 2.74
Earnings per share				$ 1.20	$ 1.10	$ 0.94	$ 0.75	$ 0.69
Dividend per share				0.430	0.307	0.284	0.224	0.252
Payout Ratio	0.701			0.570	0.693	0.716	0.776	0.748
Retention Rate								
Hughes Electronics (GMH)								
Earnings per share		$ 2.88	$ 2.77	$ 2.70	$ 2.30	$ (0.11)	$ 1.26	$ 1.82
Dividend per share		$ 0.96	$ 0.92	$ 0.80	$ 0.72	$ 0.72	$ 0.72	$ 0.72
Payout Ratio		0.333	0.332	0.296	0.313	(6.545)	0.571	0.396
Retention Rate	0.537	0.667	0.668	0.704	0.687	7.545	0.429	0.604
Boeing (BA)	**Growth Rate**	**1996**	**1995**	**1994**	**1993**	**1992**	**1991**	**1990**
Earnings per share (Split adjusted)		$ 1.60	$ 0.58	$ 1.26	$ 1.83	$ 1.62	$ 2.28	$ 2.01
Dividend per share		$ 0.55	$ 0.50	$ 0.50	$ 0.50	$ 0.50	$ 0.50	$ 0.48
Payout Ratio		0.344	0.862	0.397	0.273	0.309	0.219	0.236
Retention Rate	0.623	0.656	0.138	0.603	0.727	0.691	0.781	0.764
McDonnell Douglas (MD)								
Earnings per share (Split adjusted)		$ 3.64	$ (1.83)	$ 2.53	$ 1.69	$ (3.35)	$ 1.84	$ (0.44)
Dividend per share		$ 0.46	$ 0.40	$ 0.23	$ 0.23	$ 0.23	$ 0.29	$ 0.47
Payout Ratio		0.126	(0.219)	0.091	0.136	(0.069)	0.158	(1.068)
Retention Rate	0.498	0.874	1.219	0.909	0.864	1.069	0.842	2.068

NORTHROP ACQUIRES GRUMMAN FOR $62 A SHARE

Purchase method of accounting

Announced 10 March 1994 ($60 per share), 4 April ($62 per share)

Martin Marrietta originally offered $55 per share on 7 March 1994

Grumman's shares ceased trading on the NYSE after Friday 15 April 1994 once Northrop had tendered 93.4% of Grumman shares

Consummated 18 May 1994

	NORTHROP		GRUMMAN		NORTHROP GRUMMAN		
	Dec-93	Mar-94	Dec-93	Mar-94	Jun-94	Sep-94	Dec-94
	Annual	1st Qtr	Annual	1st Qtr	2nd Qtr	3rd Qtr	Annual
TOTAL ASSETS	$ 2,939	$ 3,035	$ 2,024	$ 2,034	$ 5,893	$ 6,189	$ 6,047
TOTAL LIABILITIES	$ 1,617	$ 1,675	$ 1,188	$ 1,217	$ 4,487	$ 4,764	$ 4,757
BOOK VALUE	$ 1,322	$ 1,360	$ 836	$ 817	$ 1,406	$ 1,425	$ 1,290
SHARES OUTSTANDING	48.9	49.1	34	34	49.1	49.1	49.2
BOOK VALUE/SHARE (Bv)	$ 27	27.70	$ 24.59	$ 24.03	$ 28.64	$ 29.02	$ 26.22
NET INCOME/SHARE	$ 1.99	$ 1.05	$ 1.67	$ (0.27)	$ 1.33	$ 0.79	$ 5.00
DIVIDEND PER SHARE	$ 1.60	$ 0.40	$ 1.15	$ 0.30	$ 0.40	$ 0.40	$ 1.60
DIVIDEND PAYOUT RATIO (Period)	80%	38%	69%	-111%	30%	51%	32%
RETENTION RATE	20%	62%	31%	211%	70%	49%	68%
COST OF CAPITAL							
T- bill rate	3.078%	3.366%	3.078%	3.366%	4.136%	4.635%	4.430%
Risk Premium (annualized)	6.147%	6.147%	6.609%	6.609%	6.321%	6.321%	6.321%
TOTAL COST OF CAPITAL (r)	9.225%	9.513%	9.687%	9.975%	10.457%	10.956%	10.751%
Stock Price range during Acc period							
hi	42.6	45.88	hi 41.9	67.37	hi 39.75	45.37	47.37
low	30.5	36.88	low 24.1	36	low 34.5	35.34	34.5
Closing Stock Price (P)	$ 37.38	$ 39.88	$ 40.13	$ 62.00	$ 37.13	$ 45.25	$ 42.00

LOCKHEED CORP (LK) MERGES WITH MARTIN MARIETTA (ML)

Pooling method of accounting
Announced 29 August 1994
FTC approval 10 Jan 95
Consummated 15 Mar 95 (Last day both stocks traded individually)

	LOCKHEED			MARTIN MARIETTA			LOCKHEED MARTIN	
	Dec-93	Jun-94	Dec-94	Dec-93	Jun-94	Dec-94	Mar-95	Dec-95
	Annual	six months	Annual	Annual	six months	Annual	1st Qtr	Annual
TOTAL ASSETS	$ 8,961	8961	$ 9,113	$ 7,745	$ 7,745	$ 8,538	$ 17,958	$ 17,648
TOTAL LIABILITIES	$ 6,518	6267	$ 6,306	$ 4,869	$ 4,738	$ 5,167	$ 11,780	$ 11,215
PREFERRED STOCK	na	na	na	1000	1000	1000	1000	1000
BOOK VALUE	$ 2,443	2694	$ 2,807	$ 1,876	$ 2,007	$ 2,371	$ 5,178	$ 5,433
SHARES OUTSTANDING	62.7	62.9	63	95.7	96	96	199.7	200
BOOK VALUE/SHARE (Bv)	$ 39	42.83	$ 44.56	$ 19.60	$ 20.91	$ 24.70	$ 25.93	$ 27.17
NET INCOME/SHARE	$ 6.70	3.09	$ 7.00	$ 3.80	$ 3.01	$ 5.05	$ 0.62	$ 3.05
DIVIDEND PER SHARE	$ 2.12	1.10	$ 2.24	$ 0.87	$ 0.45	$ 0.93	$ 0.29	$ 1.34
DIVIDEND PAYOUT RATIO (period)	32%	36%	32%	23%	15%	18%	47%	44%
RETENTION RATE	68%	64%	68%	77%	85%	82%	53%	56%
COST OF CAPITAL								
T- bill rate	3.078%	3.751%	4.430%	3.078%	3.751%	4.430%	5.946%	5.659%
Risk Premium (annualized)	5.600%	5.600%	5.600%	5.742%	5.742%	5.742%	5.277%	5.277%
TOTAL COST OF CAPITAL (r)	8.678%	9.351%	10.030%	8.820%	9.493%	10.172%	11.223%	10.936%
Stock Price range during Acc period								
hi	$ 72.40	$ 68.75	$ 79.50	hi $ 46.60	$ 46.50	$ 51.00	hi $ 54.37	$ 79.00
low	$ 54.30	$ 58.34	$ 58.75	low $ 32.00	$ 40.87	$ 40.87	low $ 50.14	$ 51.63
Closing Stock Price (P)	$ 69.00	$ 70.00	$ 73.13	$ 44.50	$ 44.00	$ 45.00	$ 52.88	$ 79.00

Raytheon Acquires E-Systems for $64 per share											
Purchase method of accounting											
Announced 3 April 1995											
DOJ approved, not announced											
Consummated 8 May 95 (Last day E-Systems shares traded)											
	Raytheon (split adjusted)				**E-Systems**				**Raytheon**		
	Dec-93	Dec-94	Mar-95		Dec-93	Dec-94	Mar-95		Jun-95	Sep-95	Dec-95
	Annual	Annual	1st Qtr		Annual	Annual	1st Qtr		2nd Qtr	3rd Qtr	Annual
TOTAL ASSETS	$ 7,258	$ 7,396	$ 7,674		$ 1,279	$ 1,374	$ 1,439		$ 10,142	$ 10,264	$ 9,841
TOTAL LIABILITIES	$ 2,960	$ 3,467	$ 3,617		$ 509	$ 537	$ 579		$ 6,025	$ 6,071	$ 5,549
BOOK VALUE	$ 4,298	$ 3,929	$ 4,057		$ 770	$ 837	$ 860		$ 4,117	$ 4,193	$ 4,292
SHARES OUTSTANDING	271	264	246		34	34	34		244	234	240
BOOK VALUE/SHARE (Bv)	$ 15.86	$ 14.88	$ 16.49		$ 22.65	$ 24.62	$ 25.29		$ 16.87	$ 17.92	$ 17.88
NET INCOME/SHARE	$ 2.56	$ 2.26	$ 0.71		$ 3.58	$ 2.79	$ 0.85		$ 0.80	$ 0.80	$ 3.25
DIVIDEND PER SHARE	$ 0.70	$ 0.74	$ 0.19		$ 1.10	$ 1.20	$ 0.38		$ 0.19	$ 0.19	$ 0.75
DIVIDEND PAYOUT RATIO (Period)	27%	33%	26%		31%	43%	44%		23%	23%	23%
RETENTION RATE	73%	67%	74%		69%	57%	56%		77%	77%	77%
COST OF CAPITAL											
T- bill rate	3.078%	4.430%	5.946%		3.078%	4.430%	5.946%		5.722%	5.536%	5.659%
Risk Premium (annualized)	5.746%	5.746%	5.746%		6.232%	6.232%	6.232%		5.878%	5.878%	5.878%
TOTAL COST OF CAPITAL (r)	8.824%	10.176%	11.692%		9.310%	10.662%	12.178%		11.600%	11.414%	11.537%
Stock Price range during Acc period											
hi	34.3	34.44	37.19	hi	49.1	47	45.375	hi	38.18	42.69	47.25
low	25.3	30.25	31.4	low	36.1	37	40.75	low	31.44	38.75	31.44
Closing Stock Price (P)	$ 33.00	$ 31.94	$ 36.44		$ 43.00	$ 41.63	$ 45.38		$ 38.18	$ 39.81	$ 47.25

LOCKHEED MARTIN (LMT) ACQUIRES LORAL for $38 per share plus stock in new Loral Space & Communications										
Purchase method of accounting										
Announced 7 January 1996										
FTC approval 19 April 96										
Consummated 29 April 96 (Last day shares of Old Loral traded)										
	LOCKHEED MARTIN			LORAL (FY Mar 31st)				LOCKHEED MARTIN		
	Dec-95	Mar-96		Sep-95	Dec-95	Mar-96		Jun-96	Sep-96	Dec-96
	Annual	1st Qtr		2nd Qtr	3rd Qtr	Annual		2nd Qtr	3rd Qtr	Annual
TOTAL ASSETS	$ 17,648	$ 17,682		$ 5,827	$ 5,829	$ 5,983		$ 30,328	$ 30,269	$ 29,257
TOTAL LIABILITIES	$ 11,215	$ 11,026		$ 3,968	$ 3,865	$ 4,214		$ 23,416	$ 23,080	$ 22,401
PREFERRED STOCK	1000	1000						1000	1000	1000
BOOK VALUE	$ 5,433	$ 5,656		$ 1,859	$ 1,964	$ 1,769		$ 5,912	$ 6,189	$ 5,856
SHARES OUTSTANDING	200	199		175	176.5	176.5		200	193	193
BOOK VALUE/SHARE (Bv)	$ 27.17	$ 28.42		$ 10.62	$ 11.13	$ 10.02		$ 29.56	$ 32.07	$ 30.34
NET INCOME/SHARE	$ 3.05	$ 1.22		$ 0.47	$ 0.52	$ 2.10		$ 1.33	$ 1.38	$ 6.04
DIVIDEND PER SHARE	$ 1.34	$ 0.40		$ 0.08	$ 0.08	$ 0.24		$ 0.40	$ 0.40	$ 1.60
DIVIDEND PAYOUT RATIO (period)	44%	33%		17%	15%	11%		30%	29%	26%
RETENTION RATE	56%	67%		83%	85%	89%		70%	71%	74%
COST OF CAPITAL										
T- bill rate	5.659%	5.053%		5.536%	5.433%	5.436%		5.417%	5.203%	5.137%
Risk Premium (annualized)	5.277%	5.277%		6.549%	6.549%	6.549%		5.277%	5.277%	5.277%
TOTAL COST OF CAPITAL (r)	10.936%	10.330%		12.085%	11.982%	11.985%		10.694%	10.480%	10.414%
Stock Price range during Acc period										
hi	79.5	80.87	hi	28.93	35.37	48.87	hi	86.75	91.75	95.12
low	50	73.12	low	22.5	27.75	36.25	low	73	76.25	73
Closing Stock Price (P)	$ 79.00	$ 75.87		$ 28.50	$ 35.37	$ 49.00		$ 84.00	$ 90.12	$ 91.50

Boeing merges with McDonnell Douglas: MD shareholders receive 1.3 shares of BA stock (split adjusted)														
Pooling method of accounting														
Announced 15 Dec 96														
FTC approval 2 July 97														
Consummated 1 Aug 97														
	Boeing	(adjusted for 2 for 1 split 6 June 97)					**McDonnell Douglas**						**Boeing**	
	Dec-95	Sep-96	Dec-96	Mar-97	Jun-97		Dec-95	Sep-96	Dec-96	Mar-97	Jun-97		Sep-97	
	Annual	3rd qtr	Annual(1)	1st Qtr	2nd Qtr		Annual	3rd Qtr	Annual	1st Qtr	2nd Qtr		3rd Qtr (2)	
TOTAL ASSETS	$ 22,098	$ 22,002	$ 27,254	$ 28,292	$ 28,861		$ 10,466	$ 10,948	$ 11,631	$ 11,606	$ 11,628		$ 39,374	
TOTAL LIABILITIES	$ 12,200	$ 12,129	$ 16,313	$ 17,103	$ 17,418		$ 7,425	$ 7,924	$ 8,593	$ 8,402	$ 8,249		$ 25,504	
BOOK VALUE	$ 9,898	$ 9,873	$ 10,941	$ 11,189	$ 11,443		$ 3,041	$ 3,024	$ 3,038	$ 3,204	$ 3,379		$ 13,870	
SHARES OUTSTANDING	688	688	721	721	721		236	224	210	210	210		972	
BOOK VALUE/SHARE (Bv)	$ 14.39	$ 14.35	$ 15.17	$ 15.52	$ 15.87		$ 12.89	$ 13.50	$ 14.47	$ 15.26	$ 16.09		$ 14.27	
NET INCOME/SHARE	$ 0.58	$ 0.37	$ 1.60	$ 0.55	$ 0.48		$ (1.83)	$ 0.90	$ 3.64	$ 0.86	$ 0.93		$ (0.72)	
DIVIDEND PER SHARE	$ 0.50	$ 0.14	$ 0.55	$ 0.14	$ 0.14		$ 0.40	$ 0.12	$ 0.46	$ 0.12	$ 0.12		$ 0.14	
DIVIDEND PAYOUT RATIO (period)	87%	38%	34%	26%	29%		-22%	13%	13%	14%	13%		-19%	
RETENTION RATE	13%	62%	66%	74%	71%		122%	87%	87%	86%	87%		119%	
COST OF CAPITAL														
T- bill rate	5.656%	5.203%	5.137%	5.217%	5.140%		5.656%	5.203%	5.137%	5.217%	5.140%		5.132%	
Risk Premium (annualized)	5.826%	5.826%	5.826%	5.826%	5.826%		6.102%	6.102%	6.102%	6.102%	6.102%		5.990%	
TOTAL COST OF CAPITAL (r)	11.482%	11.029%	10.963%	11.043%	10.966%		11.758%	11.305%	11.239%	11.319%	11.242%		11.122%	
Stock Price range during Acc period														
hi	40	48	53.8	57.25	58	hi	46.1	53.25	66.5	71.75	71	hi	55	
low	22.2	39.94	37.1	49.31	52.5	low	23.3	42.5	42.1	60.38	64.25	low	53	
Closing Stock Price (P)	$ 39.19	$ 47.25	$ 53.25	$ 49.31	$ 43.56		$ 46.00	$ 52.63	$ 65.63	$ 61.00	$ 68.00		$ 54.44	
Note 1: Issued stock to purchase Rockwell's Aerospace and Defense business 6 Dec 96.														
Note 2: Issued 279 million shares of common stock to purchase MD.														

Raytheon submits bid to acquire GM's Hughes Defense Business for $9.5 Billion									
Purchase method of accounting									
Announced 16 Jan 1997									
DOJ approval 2 Oct 1997									
Merger expected to be completed in 4th Quarter 1997									
	Raytheon				Note 1	**Hughes Electronics**			Note 2
	Sep-96	Dec-96	Mar-97	Jun-97		Sep-96	Dec-96	Mar-97	Jun-97
	3rd Qtr	Annual	1st Qtr	2nd Qtr		3rd Qtr	Annual	1st Qtr	2nd Qtr
TOTAL ASSETS	$ 11,785	$ 11,126	$ 11,496	$ 11,843		$ 16,213	$ 16,480	$ 16,741	$ 21,145
TOTAL LIABILITIES	$ 7,337	$ 6,528	$ 6,779	$ 6,966		$ 7,188	$ 7,301	$ 7,454	$ 11,045
PREFERRED STOCK									401
BOOK VALUE	$ 4,448	$ 4,598	$ 4,717	$ 4,877		$ 9,025	$ 9,179	$ 9,287	$ 9,699
SHARES OUTSTANDING	236	236	236	236		400	400	400	400
BOOK VALUE/SHARE (Bv)	$ 18.85	$ 19.48	$ 19.99	$ 20.67		$ 22.56	$ 22.95	$ 23.22	$ 24.25
NET INCOME/SHARE	$ 0.80	$ 3.21	$ 0.78	$ 0.89		$ 0.63	$ 2.88	$ 0.59	$ 1.35
DIVIDEND PER SHARE	$ 0.20	$ 0.79	$ 0.20	$ 0.20		$ 0.24	$ 0.96	$ 0.25	$ 0.25
DIVIDEND PAYOUT RATIO (period)	25%	25%	26%	22%		38%	33%	42%	19%
RETENTION RATE	75%	75%	74%	78%		62%	67%	58%	81%
COST OF CAPITAL									
T- bill rate	5.203%	5.137%	5.217%	5.140%		5.203%	5.137%	5.217%	5.140%
Risk Premium (annualized)	5.873%	5.873%	5.873%	5.873%		6.744%	6.744%	6.744%	6.744%
TOTAL COST OF CAPITAL (r)	11.076%	11.010%	11.090%	11.013%		11.947%	11.881%	11.961%	11.884%
Stock Price range during Acc period									
hi	56.13	56.1	51.25	53.875	hi	60	68.3	64.87	60.25
low	34.38	43.4	43.25	41.75	low	53.5	45	54.25	49
Closing Stock Price (P)	$ 55.63	$ 48.13	$ 45.13	$ 47.50		$ 50.00	$ 56.25	$ 55.12	$ 58.50

Lockheed Martin submits bid to acquire Northrop Grumman for $11.6 Billion

Pooling method of accounting: NOC shareholders to receive 1.1923 shares of LMT for each share of NOC

Announced 3 July 1997
DOJ approval pending
Merger expected to be completed in 4th Quarter 1997

	Lockheed Martin						**Northrop Grumman**				
	Sep-96	Dec-96	Mar-97	Jun-97	Sep-97		Sep-96	Dec-96	Mar-97	Jun-97	Sep-97
	3rd Qtr	Annual	1st Qtr	2nd Qtr	3rd Qtr		3rd Qtr	Annual	1st Qtr	2nd Qtr	3rd Qtr
TOTAL ASSETS	$ 30,269	$ 29,257	$ 29,367	$ 29,398	**$ 29,514**		$ 9,513	$ 9,422	$ 9,578	$ 9,700	**$ 9,839**
TOTAL LIABILITIES	$ 23,080	$ 22,401	$ 22,275	$ 22,068	**$ 21,860**		$ 7,402	$ 7,294	$ 7,394	$ 7,438	**$ 7,338**
PREFERRED STOCK	1000	1000	1000	1000	1000						
BOOK VALUE	$ 6,189	$ 5,856	$ 6,092	$ 6,330	$ 6,654		$ 2,111	$ 2,128	$ 2,184	$ 2,262	$ 2,501
SHARES OUTSTANDING	193	193	193	194	194		58	58	58	58	61
BOOK VALUE/SHARE (Bv)	$ 32.07	$ 30.34	$ 31.56	$ 32.63	$ 34.30		$ 36.40	$ 36.69	$ 37.66	$ 39.00	$ 41.00
NET INCOME/SHARE	$ 1.38	$ 6.04	$ 1.49	$ 1.59	$ 1.51		$ 1.21	$ 3.99	$ 1.30	$ 1.72	$ 1.46
DIVIDEND PER SHARE	$ 0.40	$ 1.60	$ 0.40	$ 0.40	$ 0.40		$ 0.40	$ 1.60	$ 0.40	$ 0.40	$ 0.40
DIVIDEND PAYOUT RATIO (period)	29%	26%	27%	25%	26%		33%	40%	31%	23%	27%
RETENTION RATE	71%	74%	73%	75%	74%		67%	60%	69%	77%	73%
COST OF CAPITAL											
T- bill rate	5.203%	5.137%	5.217%	5.140%	5.132%		5.203%	5.137%	5.217%	5.140%	5.132%
Risk Premium (annualized)	5.277%	5.277%	5.277%	5.277%	5.277%		6.321%	6.321%	6.406%	6.406%	6.406%
TOTAL COST OF CAPITAL (r)	10.480%	10.414%	10.494%	10.417%	10.409%		11.524%	11.458%	11.623%	11.546%	11.538%
Stock Price range during Acc period											
hi	91.75	91.5	92.5	103.56	113.4	hi	80.25	84.3	82.63	84.5	127.8
low	76.25	73	82.5	79.25	99.13	low	63.75	57.87	71.38	70	110
Closing Stock Price (P)	$ 90.12	$ 91.50	$ 84.00	$ 103.56	$ 106.60		$ 80.25	$ 82.75	$ 75.63	$ 84.50	$ 120.00
Note: Bold Data is Preliminary											

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